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GENERAL INDEX.

(Illustrated articles are designated by an asterisk * before the page number.)

Botanical Notes, 38, 80, 176, 230, 269, 311, 380, 460, 489.

Cerebella Paspali, Germination of the Spores of, *127.
Characeæ, Japanese, 523.
Club-root in Common Weeds, *76.
Contributions to American Bryology, 1, 65, 137, *189, *343.
Contributions to the Lichens of Maine, 389.
CONTRIBUTORS:
  Allen, T. F., 162, 523, 526.
  Atkinson, George F., 81, 127.
  Barnhart, John Hendley, 491.
  Best, G. N., 527.
  Bicknell, E. P., 41, 257.
  Britton, Elizabeth G., 1, 65, 137, 189, 343.
  Britton, N. L., 27, 80, 176, 230, 239, 244, 314, 491.
  Coville, F. V., 34.
  Deane, Walter, 490.
  De Candolle, C., 160.
  Durand, Elias J , 38.
  Eckfeldt, J. W., 393.
  Halsted, Byron D., 40, 76, 129, 269, 311.
  Harvey, F. L., 389.
  Heller, A. A., 21, 314.
  Hill, E. J., 79.
  Hollick, Arthur, 49, 253, 307, 467.
  Jelliffe, S. Ely, 266, 489.
  Johnson, L. N., 285.
  Kearney, T. H , Jr., 82, 173, 260, 460, 482.
  Knowlton, F. H., 485.
  Linn, Alonzo, 529.
  Lippincott, Chas. D., 313.
  McEwen, Marion, 277.
  Morong, Thomas, 419.
  Pollard, Charles Louis, 208, 313.
  Porter, Thos. C., 120, 177, 310.
  Rusby, H. H., 487.
  Schrenk, Hermann, 226, 385.
  Scribner, F. Lamson, 37, 228.
  Simonton, Jas. S., 529.
  Small, John K., 15, 131, 168, 300, 471, 476.
  Stevens, F. L., 489.
  Stokes, Alfred C., 396.
  Sturtevant, E. Lewis, 319, 503.
  Thurston, C. O., 177.
  Tyler, A. A., 123.
  Underwood, Lucien M., 268.
  Vail, Anna Murray, 91.
  Ward Lester F., 291.
  White, Theodore G., 444.
  Weigand, Karl M., 176.
Corema alba and Corema Conradii, the Comparative Anatomy of, *277.
Cryptogamic Notes from Long Island 266, 489.

Fissidens hyalinus in Pennsylvania, 529.
Fossil Salvinias, including Description of a new Species, *253.

Genus Buettneria, Nomenclature of the, 173.
Genus Cassia in the United States, The, 208.
Genus Hempicarpa in America, The, 34.
Grasses, three new or noteworthy, *228.
Grasses, two new, 37.

Hepatic, a new Fossil, from the Lower Yellowstone in Montana, 458.

Index to Recent Literature Relating to American Botany, 47, 87, 134, 184, 234, 272, 314, 381, 416, 461, 497, 535.

Lathyrus, a Preliminary Revision of the Genus in North and Central America, 444.
Lechea, a Revision of the Genus, 244.
Lichens new to North America, 393.
Lonicera hirsuta, etc., an Examination of the Pubescence of the Styles and Filaments of, *123.

Microsphæra densissima, 528.
Morong, Death of Dr. Thomas, 230.
Morong, Thomas, 239.
Morphological Notes on the Genus Brunnichia, *131.

Nelumbo from the Laramie Group at Florence, Col., a new fossil, *307.
New and interesting Species of Polygonum, *168.
New or little known Plants of the Southern States, *260.
New or Noteworthy North American Phanerogams, *27.
New Piperaceæ from Bolivia, 160.
Note on Chara sejuncta, 526.
Notes on certain Plants of our Eastern Flora, 120.
Notes on some of the rarer Species of Polygonum, *476.
Notes on the Chromatophores of Astrophyllum sylvaticum and some other Plants, *396.
Notes on some Exoascæ of the United States, 372.
Notes on Tubercularia pezizoidea, *385.
Notes on Maize, 319, 503.

On a Species of Helianthemum not recognized in our Text-books, 257.
Organization of the Botanical Society of America, 411.
Orthotrichum gymnostomum, 527.
Oxalis, two Species of, *471.

Palæobotany of the Cretaceous Formation on Long Island, Additions to the, *49.
Plants from Bolivia, Two new Genera of, *487.
Plants from Virginia new to Gray's Manual Range, with Notes on other Species, 21.
Polygonum, new and interesting Species of 168.
Potentilla recta, 79.
Proceedings of the Botanical Club, A. A. A. S., Brooklyn Meeting, 406.

Proceedings of the Club, 42, 85, 132, 182, 232, 271, 494, 530.
Psoralea in America, A Study of the Genus, 91.

Recent Discoveries of Cycadean Trunks in the Potomac Formation of Maryland, 291.
Remarks on Chara gymnopus A. Br., with Descriptions of new Species of Chara and Nitella, *162.
Report of the Committee on Bibliography of the Madison Botanical Congress, 414.
Reviews, 232, 270, 492, 532.
Reviews and Notes on Literature, 44, 82, 178.

Selaginella from Mexico, a new, 268.
Shrinkage of Leaves in Drying, *129.
Smilaceæ of North and Central America, the, 419.
Some new and rare Desmids of the United States, 285.
Some new Florida Plants, 482.
Steps toward a Revision of the Linosporous Species of North American Graminicolous Hypocreaceæ, 222.
Studies in the Botany of the Southeastern United States, *15, *300.

Teratological Notes, *226.
Title of Papers presented before the Section of Botany, A. A. A. S., Brooklyn Meeting, 412.

Varieties of Solidago and Aster, 310.

Wing-like Appendages on the Petioles of Liriophyllum populoides, etc., *467.

GENERIC INDEX.

Abutilon, 182, 270.
Acacia, 222.
Acer, 88.
Achyrodes, 382.
Aconitum, 275, 500.
Actinomeris, 500.
Adiantum, 536.
Æsculus, 536.
Agaricus, 87, 499.
Agave, 237.
Ageratum, 403, 406.
Alectoria, 390.
Aleyrodes, 538.
Alliaria, 497.
Alnus, 76, 160.
Amaranthus, 327, 418.
Amblystegium, 268, 273, 317.
Amorpha, 17, 136.
Ampelanus, 314, 461.
Amygdalus, 17, 373.
Anacharis, 400.
Andromeda, 54, 64.
Anemone, 22.
Aneura, 489.
Andropogon, 128, 223.
Anhalonium, 315.
Anomodon, 268.
Anonymos, 22, 23.
Antennaria, 47, 265.
Antirrhinum, 275.
Aphanorhegma, 190, 199.
Aplopappus, 236.
Aquilegia, 46.
Aralia, 54, 55, 63, 64, 133.
Arctostaphylos, 277, 500.
Arcyria, 186.
Ardisia, 90.
Arisæma, 311, 312, 536.
Aristida, 224.
Aristolochia, 485, 486.
Arthonia, 395.
Arundinaria, 225.
Asarum, 265, 535.
Asclepias, 24, 236.
Aspidium, 270, 271, 537.
Asplenium, 15, 21, 88, 256, 270, 271, 498, 499.
Aster, 88, 89, 120, 121, 236, 274, 311, 464.
Asterotheca, 493.
Astragalus, 46, 89, 118, 188, 317.
Astrophia, 457.
Astrophyllum, 267, 396, 501.
Atriplex, 46.
Audibertia, 381.
Audibertiella, 381.
Azalea, 496, 531.

Bacillus, 318.
Bæomyces, 392.
Baptisia, 16, 88.
Barbarea, 315.
Barbula, 185, 267.
Bartramia, 267.
Basteria, 174.
Bazzania, 177.
Begonia, 236, 383, 404.
Bennettites, 233, 292.
Betula, 490, 537.
Beurera, 174, 175.
Beveria, 174.
Biatora, 392, 393, 394.
Bidens, 47, 274, 497.
Boerhaavia, 46.
Boisduvallia, 48.
Bolbopodium, 233.
Boletus, 235.
Brachymenium, 381.
Brachythecium, 317.
Brasenia, 308, 309.
Brassica, 77.
Bredemeyera, 273.
Bruchia, 272, 343, 416.
Brunella, 47.
Brunnichia, 131, 132, 134, 237.
Bryopteris, 383, 465.
Bryoziphium, 409.
Bryum, 185, 192, 267.
Buellia, 393.
Bulbostylis, 29.
Bumelia, 276.
Bursa, 76, 186.
Butneria, 173, 174.
Büttneria, 173, 174, 175, 275.
Buxbaumia, 38, 39, 40, 135.
Byttneria, 173.

Cactus, 315.
Calamintha, 40.
Calochortus, 47, 135, 416.
Calycanthus, 174, 175, 464.
Camptosorus, 21, 536.
Cantherellus, 235.
Caraguata, 314.
Cardamine, 499.
Carex, 122, 123, 263, 264, 316, 382.
Carpinus, 379.
Carpites, 470.
Cassia, 81, 184, 208, 313 464.
Castanea, 261, 262, 316.
Catalpa, 130.
Catharinea, 266, 267, 273.
Caulinites, 63.
Ceanothus, 46, 381.
Cedrela, 499.
Cedronella, 32, 33.
Celastrophyllum, 58, 59, 64.
Celtis, 301, 394.
Ceratiola, 278.
Ceratiomyxa, 413.
Ceratodon, 267.
Cercis, 318.
Cerebella, 127, 128, 234.
Cereus, 417.
Cetraria, 390.
Chænactis, 46.
Chætophora, 235.
Chætostroma, 187.
Chalara, 413.
Chara, 162, 163, 164, 165, 167, 272, 497, 523, 526, 531.
Chenopodium, 532.
Chionanthus, 465.
Chironia, 24.
Chrysopsis, 274.

Cinchona, 182.
Cinnamomum, 53, 65, 233.
Cissites, 57, 63.
Cistus, 257, 258.
Cladonia, 392, 532, 533.
Cladophlebis, 271.
Clathraria, 233.
Clathropodium, 233.
Clavaria, 235.
Claytonia, 235.
Clematis, 188.
Climacium, 268.
Clintonia, 272.
Closterium, 286.
Coleus, 40.
Collema, 391, 492, 533.
Collinsonia, 264.
Colutea, 56, 63.
Comarum, 47.
Completoria, 535.
Conocephalus, 188, 409.
Conotrema, 392.
Copernicia, 243.
Coprinus, 235.
Coprosmanthus, 422, 423, 424.
Corallorhiza, 261.
Cordaites, 493.
Cordyceps, 224.
Corema, 133, 278, 464.
Coreopsis, 307.
Corispermum, 31.
Corticium, 388.
Coscinodiscus, 84
Cosmarium, 287, 288, 289, 290, 291, 463.
Cotyledon, 237.
Cracca, 303, 465, 501
Crassula, 237.
Cratægus, 231, 273, 383.
Cribraria, 186, 501.
Cristaria, 270.
Crotalaria, 22.
Cryptanthe, 46.
Cryptoglena, 185.
Cucumis, 237.
Cunila, 40, 87, 133.
Cupressus, 317.
Cuscuta, 304, 383, 417.
Cycadeoidea, 232, 233, 293, 465.
Cycadites, 233.
Cycadomyelon, 293.
Cycas, 89, 233.
Cylindrothecium, 268.
Cymopterus, 46.
Cyperites, 63, 64.
Cyperus, 28, 29.
Cypressus, 382
Cypripedium, 88, 496.
Cyrilla, 23.

Dalbergia, 255, 256.
Dalea, 501.
Darbya, 136.
Delavayella, 136.
Delphinium, 82, 83, 382.
Dianthera, 25.
Dichelyma, 268.
Dichroma, 30.
Dichromena, 30.
Dicranella, 267, 317.
Dicranum, 69, 267.
Dictyosphærium, 87.
Diospyros, 53, 64.
Diplacus, 315.
Diplazium, 498.
Disporum, 260.
Ditrichum, 267, 359.
Doassansia, 317, 499.
Dodecatheon, 236.
Dothichloë, 222, 223, 224, 225, 273.
Dothidea, 223.
Dracocephalum, 32, 33, 134, 275.
Drummondia, 267.
Dryopteris, 186.
Dulichium, 29.
Dyckia, 134.

Echinocactus, 89, 188.
Echinodothis, 222, 273.
Eleocharis, 31.
Elephantopus, 183.
Elliottia, 276.
Elodea, 400.
Empetrum, 278.
Empusa, 384.
Encalpyta, 413.
Enslenia, 314, 461.
Enteridium, 186.
Entosthodon, 207.
Entyloma, 317, 409.
Ephedra, 46.
Epichloë, 222, 223, 224
Epigæa, 88, 496.
Epilobium, 177, 500.
Epiphegus, 136.
Equisetum, 233.
Eragrostis, 187.
Eremanthus, 89.
Erigeron, 19, 306, 307.
Eriocaulon, 243.
Eriogonum, 46.
Erysiphe, 528.
Erythonium, 134.
Erythrina, 501,
Erythroxylon, 88, 275.
Eschscholtzia, 382.
Euastrum, 286, 287, 291.
Eucalyptus, 55, 56, 64.
Eucephalartos, 233.
Eunephrodium, 135.
Euphorbia, 47, 263.
Eustichia, 461.
Eustichium, 409.
Evernia, 390.
Exoascus, 373, 498.

Fagus, 261.
Festuca, 38, 229, 317.
Ficus, 51, 52, 64.
Fimbriaria, 177.
Fimbristylus, 29, 30.
Fissidens, 268, 316, 317, 381, 529.
Fluckigeria, 413, 488, 489.
Fontinalis, 268.
Forsythia, 536,
Fossombronia, 136.
Frasera, 187.
Fraxinus, 48, 188, 501.
Fritillaria, 187.
Frullania, 69, 316, 384, 489.
Funaria, 267.

Galax, 24.
Galera, 182.
Galium, 31, 32, 134, 260.
Gaultheria, 500.
Gaya, 270.
Gaylussacia, 18, 19, 23, 24, 122.
Gayophytum, 46, 48.
Gentiana, 24, 182, 537.
Georgia, 267.
Geranium, 498.
Gerardia, 496.
Glaux, 46.
Gliciridia, 501.
Glyceria, 38.
Graphis, 393.
Grewiopsis, 59, 63.
Grimmia, 11, 267.
Guarea, 87, 499.
Gymnostomum, 73, 192, 193, 194, 195, 201, 202.
Gynerium, 275.

Habenaria, 496.
Haematococcus, 408.

Hamamelis, 531.
Harpidium, 136.
Hedeoma, 40.
Hedysarum, 23, 114, 115.
Hedwigia, 69, 268.
Helenium, 27, 496.
Helianthemum, 133, 244, 252, 257, 315.
Helianthus, 129, 130, 274.
Heliopsis, 47.
Heliotropium, 404.
Hemicarpha, 34, 35, 36, 37, 134.
Hemitomes, 382.
Hepatica, 416, 464.
Hesperalcea, 270.
Heterosmilax, 419.
Heuchera, 498.
Hibiscus, 303.
Hieracium, 20, 136.
Hillia, 275
Hippeastrum, 184.
Holomitrium, 381.
Hookeria, 315.
Hordeum, 537.
Houlletia, 382.
Hyalotheca, 286.
Hydrastis, 276.
Hydrolea, 25.
Hylocomium, 268.
Hymenæa, 56, 64.
Hypericum, 188, 381, 501.
Hypnum, 136, 268.
Hypocrea, 222, 223, 224, 386, 387, 388, 501.
Hypocrella, 222, 223, 224.
Hypocryta, 498.
Hypopterygium, 381.

Iberis, 77.
Ilex, 498, 501.
Ilysanthes, 494, 495.
Impatiens, 275.
Indigofera, 119.
Inga, 501.
Ipomœa, 417, 537.
Iris, 22.
Isaria, 234.
Isoetes, 300.
Isolepis, 30, 34.
Isopyrum, 187.

Jacksonia. 47, 235, 236.
Juglans, 51, 64, 501.
Juncodes, 188, 274.
Juncus, 46, 181.
Justicia, 25.

Koellia, 25.
Kuhnistera, 314.

Laciniaria, 188.
Lactuca, 535.
Lagerstrœmia, 18.
Lamium, 275.
Lastrea, 135, 187.
Lathyrus, 416, 444, 538.
Laurus, 52, 53, 64.
Lecanora, 391.
Lechea, 23, 244, 315.
Lecidea, 393.
Lecidium, 252.
Leguminosites, 56, 61, 64.
Leitneria, 318.
Lemna, 490, 536.
Lepidium, 274.
Lepidopilum, 185, 381.
Leptobryum, 267.
Leptogium, 391.
Leucampyx, 82, 187.
Leuchtenbergia, 89.
Leucobryum, 267.
Leucodon, 268.
Leucomium, 315.
Lewisia, 498.
Licania, 135.
Licea, 501.
Linnæa, 500.
Linum, 23, 253.
Liquidambar, 501.
Liriodendron, 61, 62, 64, 409, 467, 497.
Liriodendropsis, 468.
Liriophyllum, 467, 470, 471, 497.
Listera, 244.
Litsea, 233.
Lonicera, 123, 237, 305.
Lophophora, 315.
Lophopappus, 413, 487, 489.
Lotodes, 91, 93, 94, 112.
Lupinus, 382.
Lythrum, 47.

Maclura, 275.
Macronema, 274.
Magnolia, 60, 61, 64, 501.
Malpighia, 500.
Malva, 47, 270.
Malvæopsis, 270.
Malvastrum, 270.
Mandevillia, 500.
Mantellia, 232, 233.
Marchantia, 458, 459, 489, 533.
Marchantites, 459.
Marsdenia, 500.
Marsilia, 256, 406.
Mascagnia, 500.
Matthiola, 77.
Meehania, 32, 33, 134.
Meibomia, 23, 115, 183.
Melia, 16, 136.
Melilotus, 114.
Melissa, 40, 41, 135.
Menispermites, 59, 65.
Mentha, 40, 122, 177.
Mertensia, 46, 136.
Mesembryanthemum, 404.
Micrasteria, 135, 287.
Microsphæra, 383, 528.
Microthamnium, 381.
Mikania, 237.
Milium, 327, 329.
Mnium, 396, 502.
Mohavia, 46.
Mollia, 267.
Monarda, 40.
Monnia, 273.
Morchella, 235.
Morus, 48.
Myosotis, 122.
Myrica, 59, 273, 500, 537.
Myriogenospora, 225, 273.
Myriophyllum, 243.
Myrrhidendron. 535.
Myrsine, 54, 64.
Myrtophyllum, 55, 64.

Nægelia, 136.
Nama, 25.
Navarretta, 46.
Nelumbo, 233, 272, 307, 463.
Nelumbium, 309.
Nemophila, 46.
Nepeta, 40.
Nephrodium, 135, 187.
Nephroma, 391.
Nephromium, 493.
Neuropteris, 493.
Nitella, 165, 166, 167, 272, 400, 523.
Nostoc, 89.
Notothylos, 464.
Nuphar, 243.
Nymphæa, 234, 497.
Nyssa, 18, 383.

Oakesia, 279.
Obolaria, 500.
Odontostomum, 463.

Œnothera, 46, 187, 274.
Olpidium, 410.
Olpitrichum, 314.
Omphalea, 182.
Onoclea, 413.
Onychonema, 286, 291.
Ophiodothis, 223, 224.
Ophioglossum, 254, 255, 256.
Opuntia, 500.
Orechænactis, 46.
Orobus, 444, 448, 449, 450, 453, 454, 456, 457.
Orthotrichum, 1, 65, 68, 70, 134, 137, 184, 267, 273, 352, 527.
Oryza, 535.
Osmunda, 537.
Ostrya, 185.
Oxalis, 471, 472, 473, 474, 475, 531.

Pachira, 237.
Pæonia, 410.
Paliurus, 57, 64.
Panicularia, 37, 136.
Panicum, 22, 129.
Pannaria, 391, 393.
Parmelia, 390.
Paspalum, 127, 225.
Passiflora, 383.
Patellaria, 394.
Pecopteris, 270, 493.
Pellia, 489
Peltandra, 311, 312.
Peltanthera, 89.
Peltigera, 391.
Pentarhaphia, 135.
Pentstemon, 25, 46, 135, 304, 501.
Peperomia, 160, 161, 274.
Peramium, 496.
Periandra, 501.
Peromnion, 381.
Pertusaria, 392.
Petalostemon, 314.
Petunia, 274, 417.
Peziza, 464.
Phacelia, 46, 272, 303, 304.
Phænix, 237.
Phascum, 343, 347, 349, 351, 352, 362, 363, 372.
Phaseolus, 226.
Phegopteris, 408.
Phleospora, 46.
Phlox, 46, 383.
Phoradendron, 500.
Phragmicoma, 383, 465.
Phragmites, 63.
Phyllites, 59, 62, 256, 468.
Phyllocactus, 501.
Phyllogonum, 46.
Phyllosticta, 187.
Physalis, 485.
Physcia, 390.
Physcomitrium, 189, 529.
Phytelephas, 466.
Picea, 27, 28, 69.
Pilobolus, 185.
Pilocarpus, 537.
Pinus, 62, 90, 187, 316, 413, 501, 536.
Piper, 161, 274.
Pisum, 445, 450.
Placodium, 391.
Plagiochila, 489.
Plagiothecinm, 268.
Plantago, 129.
Plasmodiophora, 76, 78, 186.
Platanus, 59, 409, 469, 470.
Pleodorina, 383, 461, 464.
Pleuridium, 344, 348, 372.
Pluchea, 133, 265, 266, 483, 484.
Pluteola, 182.
Poa, 38, 136, 228, 317.
Poacites, 63, 64.
Podophyllum, 269, 316, 489, 498, 536.
Podozamites, 62, 65.
Pohlia, 273.
Polanisia, 47, 235, 236.
Polycystis, 128, 185.
Polygonum, 31, 89, 168, 234, 317, 476.
Polypodium, 408, 499.
Polytrichum, 266.
Pontederia, 130.
Populus, 46, 63, 233, 380, 413, 465.
Porella, 489.
Porotrichum, 381.
Portulaca, 130.
Potamogeton, 235, 243, 276.
Potentilla, 31, 79, 80, 186.
Pottia, 267.
Preissia, 459, 536.
Preissites, 458.
Prionodon, 381.
Protæoides, 52, 64.
Protococcus, 418.
Proustia, 487.
Prunus, 188, 237, 301, 373, 461.
Psoralea, 91, 238.
Pterobryum, 185.
Pterophyllum, 62.
Ptychanthus, 383, 465.
Ptychomitrium, 497.
Puccinia, 40, 41, 135, 416, 535.
Pycnanthemum, 25, 40.
Pylaisia, 268.
Pyramidula, 189, 206.
Pyrenula, 395, 396.
Pyrocoma, 236, 274.
Pythium, 413.

Quercus, 158, 233, 236, 275, 464, 528, 536.

Radula, 489.
Ramalia, 389, 390.
Ramona, 381.
Ranunculus, 22, 41, 42, 134, 188, 236, 272.
Rapa, 77.
Raphanus, 77.
Raumeria, 233.
Ravenalia, 235.
Rhamnus, 58, 64, 184, 233.
Rheum, 490.
Rhipogonum, 419.
Rhipsalis, 317.
Rhododendron, 496.
Rhus, 188, 486, 487.
Ribes, 275.
Riccia, 384, 489, 533.
Richardia, 318, 462.
Robinia, 275, 464.
Rosa, 416.
Rubus, 19, 120, 265.

Sabbatia, 24.
Sachsia, 315.
Salix, 50, 63, 64, 65, 274.
Salsola, 382.
Salvia, 133, 499.
Salvinia, 253, 316.
Sambucus, 186.
Sapindus, 57, 64.
Sapotacites, 62.
Saprolegnia, 464.
Sapromyces, 136.
Sarracenia, 48.
Sassafras, 53, 63.
Saxifraga, 262, 263, 316.
Scapania, 489
Schistostega, 497.
Schœnus, 29.
Scirpus, 29, 30, 34, 35.
Scleria, 176.
Scleroderma, 235.
Scouleria, 413, 497.
Scutellaria, 47, 177, 187, 276, 482.
Selaginella, 268, 269, 318, 402, 405, 499.
Senecio, 274.
Serenopsis, 49.
Sesbania, 275, 536.

Sherardia, 313, 463.
Sicyos, 275.
Sida, 270.
Sidastrum, 270.
Siphonoglossa, 500.
Sipolisia, 89.
Sisymbrium, 76, 186, 275.
Smilacina, 466.
Smilax, 242, 301, 419, 537.
Sobralia, 88, 500.
Solanum, 464.
Solidago, 26, 27, 120, 236, 310, 311, 464.
Sparganium, 176, 266, 496.
Spergularia, 46.
Sphaeralcea, 270.
Sphaerangium, 267.
Sphaerocephalus 267.
Sphaerophorus, 393.
Sphaeroplea, 316.
Sphaerozosma, 286.
Sphenopteris, 493.
Spiræa, 262, 491.
Spirogyra, 410.
Spirotænia, 286.
Sporledera, 343, 344, 346, 348, 349, 351, 352, 367.
Sporodesmium, 128.
Stachys, 382.
Staurastrum, 288, 289, 290, 291, 463.
Steironema, 264, 265, 316, 460, 536.
Stellaria, 381.
Stenophyllus, 29, 30, 134.
Stenotus, 274.
Stephaniella, 135.
Stereocaulon, 392.
Stereodon, 268.
Sticta, 391.
Strobilites, 233.
Struthanthus, 500.
Stylosanthes, 116.
Synchytrium, 381.
Synthyris, 274.

Tabernæmontana, 500.
Taphrina, 378, 380, 413.
Tephrosia, 237.
Tetmemorus, 285.
Tetramerium, 500.
Teucrium, 484.
Thamnium, 317.
Thecaphora, 128.
Thelia, 268.
Theloschistes, 390.
Thelotrema, 394.
Thinnfeldia, 233.
Thuidium, 267, 268.
Thuya, 148.
Thymus, 40.
Thysananthus, 383, 465.
Tigridia, 273.
Tillandsia, 177, 237.
Tmesipteris, 255, 256.
Tolypella, 166.
Tolyposporium, 317, 416.
Torreya, 413.
Tortula, 273.
Trentepholia, 238.
Tricalycites, 62, 63, 65.
Trichia, 186.
Trichilia, 87, 499.
Trichocentrum, 500.
Trichocolea, 489.
Trichomanes, 88, 536.
Trichostema, 483.
Trifolium, 47, 114, 176, 302, 465.
Trillium, 88, 417, 464, 496, 536.
Triticum, 327, 329, 331, 381.
Tropidocarpum, 535.
Trypethelium, 395.
Tsuga, 76, 157, 160, 501.
Tubercularia, 385. 386, 387, 388, 501.
Tuckermania, 278.
Tussilago, 497.
Typha, 63, 65.
Tysonia, 233, 293.

Ulmaria, 491.
Ulmus, 89, 536.
Ulota, 65, 144, 152, 158, 159, 185, 273.
Umbilicaria, 390, 391.
Uniola, 229, 230, 317.
Uredo, 416.
Urocystis, 128.
Uromyces, 46, 276, 311, 499.
Usnea, 390.
Ustilago, 317.
Utricularia, 26, 236.

Vaccinium, 24, 31, 121.
Vanilla, 186.
Verbena, 496.
Veronica, 122.
Viburnum, 54, 59, 64, 306.
Vicia, 444, 445, 455, 456, 458.
Vigna, 237.
Viola, 48, 234, 464.

Weissia, 65, 68, 159, 185, 267, 273.
Wulfenia, 274.

Xanthidium, 289, 291.
Xanthoxylum, 188.
Xylographa, 393.
Xyris, 300, 465.

Yucca, 237.

Zamiostrobus, 233.
Zamites, 233, 271.
Zanthoxylum, 133.
Zea, 227, 319, 522.
Zizyphus, 58, 64, 65.
Zornia, 23.
Zygodon, 69.

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BULLETIN

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AND OTHER MEMBERS OF THE CLUB.

CONTENTS:

PAGE.

Contributions to American Bryology, IV.: *Elizabeth G. Britton* 1
Studies in the Botany of the Southeastern United States.—I. (Plates 170, 171): *John K. Small* 15
Plants from Virginia new to Gray's Manual Range with Notes on other Species: *A. A. Heller* 21
New or Noteworthy North American Phanerogams.—VIII. (Plate 173): *N. L. Britton* 27
The Genus *Hemicarpa* in America: *F. V. Coville* 34
Two new Grasses: *F. Lamson-Scribner* . . 37

PAGE.

BOTANICAL NOTES.—*Buxbaumia indusiata* in Central New York: *Elias J. Durand;* The Mint Rust upon the variegated Balm: *Byron D. Halsted; Ranunculus micranthus* Nutt.: *E. P. Bicknell* . . . 38
PROCEEDINGS OF THE CLUB 42
REVIEWS AND NOTES ON LITERATURE.—Introduction to Botany; Botany of the Death Valley Expedition; Contributions to the Life-histories of Plants; Enumeration of the Myrtaceæ of Brazil 44
INDEX TO RECENT LITERATURE RELATING TO AMERICAN BOTANY 47

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BULLETIN

OF THE

TORREY BOTANICAL CLUB.

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Contributions to American Bryology, IV.

NOTES ON THE NORTH AMERICAN SPECIES OF ORTHOTRICHUM—II.

B. Those with immersed stomata.

ORTHOTRICHUM STRANGULATUM Beauv. Prod. 81 (1805). As the "Prodrome des cinquième et sixième familles de L'Æthéogamie, les Mousses, les Lycopodes par A. M. F. J. Palisot-Beauvois," is a rare book and not likely to be consulted by many to verify my statements, I quote the original description in full, especially as the specimens in Schwægrichen's herbarium supposed to be authentic do not agree with the original description:

> Orth. *strangulatum;* caule erecto diviso; foliis lanceolatis, costa integra notatis; pyxidibus subimmersis, suborificio strangulatis; calyptra fusca, brevi, cupulæformi.
>
> Cette espèce m'a èté envoyée de l'Amérique septentrionale, par le docteur Mühlenberg. Elle ressemble, par ses feuilles a l'*Orth. commune* (*anomalum*); par sa coiffe a l'*Orth. cupulatum;* ses tiges sont plus petites que celles de la première, et toutes ses parties, en général, plus grosses que dans les secondes; mais elle se distingue complètement par son urne, qui, dans la sécheresse, au-dessus de l'espèce d'anneau qui supporte les dentes, est ressérrée et étranglée, ce qui lui donne un peu le port de l'urne des *Splachnum.*

Now the description of the capsules seems to refer to the species to which Sullivant applied the name (Sull. Icon. 57, *t. 36* (1864) a tree species, with double peristome, the teeth united in pairs, and eight cilia, quite distinct from the species which Schwægrichen figured and described in his Supplement (1: ii. 33, *t. 54*

(1816), as any one may see by comparing the figures, and which I have verified by seeing his specimens from the Boissier Herbarium. Not only are the capsules not strangulate, but they belong to the other section of the group of those with immersed stomata, to the rock species to which Beauvois compared them, those with a simple peristome, without cilia, teeth single, striolate, and erect when dry. It seems probable, then, that the types of *O. strangulatum* are not the specimens in the Boissier Herbarium, but must be looked for in the Delessert Herbarium, where I understand that Palisot de Beauvois' specimens are preserved.

ORTHOTRICHUM STRANGULATUM Schwægr. Suppl. **1**: ii. 33, *t. 54* (1816).

The specimens used by Schwægrichen to figure for his Supplement were received by me from the Boissier Herbarium, November 24, 1893. The label reads *Orthotrichum strangulatum,*
Muhlbg. b. b. a Palisot s. n.

The specimens are abundant and in fine condition. The two upper ones on the right are marked b. b., and are the ones referred to in the label as having been sent to him by Palisot de Beauvois. In two little packets are preserved the peristome, bracts and leaves which were used in making the drawings for *t. 54*, and are correctly represented in the figures, excepting that the teeth are drawn with too many joints, the originals having only 6–8 segments, the three upper being longer than broad, papillose and striolate. In one capsule, from which the lid had just fallen, the teeth were united by a hyaline membrane, forming rudimentary cilia. The teeth are set deep, with an annulus of two rows of thin cells projecting above the rim of the capsule, which is also bordered by three or four rows of darker brown and denser cells. The preperistome, if present, is very difficult to see, though I did not care to examine but one capsule in searching for it. The ridges are broad, of 4–5 rows of cells, with broad spaces between them, and occasionally traces of narrower ridges with colored cells between them. The stomata are immersed, in two rows between the base of the spore-sac and the mouth, they are closed.

The leaves are 2–3 mm. long, the perichætial the longer, with a prominent vein ending below the apex, the upper cells large, hexagonal, the lower oblong with large, brown auricles at the basal angles, which, however, are difficult to see, as they tear off in dissecting. The margins are revolute and the cells papillose.

All the other characters of the species are correctly represented on table LIV., the short stems, 5–10 mm. high, with brown tomentum at base, the leaves densely crowded above, the capsules immersed, with only the red bordered lid projecting above them, the hairy calyptra, and the cylindric capsule, 1. 5 mm. long, the neck, .5 mm. There are no old empty capsules on these specimens, so that none are strangulate, but one or two are contracted below the mouth when dry.

Even before seeing the specimens I became convinced that the species figured in t. LIV. was the same *O. Porteri*, Austin. The type localities are the same, Lancaster, Pennsylvania. I have compared them macroscopically and microscopically and cannot find any difference between them.

I have also learned through the kindness of Dr. Farlow that Sullivant's copy of Schwægrichen's supplement is annotated as follows:

> " LIV. This may be a small form of *O. cupulatum* and probably is what I have in Austin's Musci Appal. called *O. Porteri.* It is clearly not what has long passed among us as *O. strangulatum.* Both Hooker and Wilson have referred to this plate as belonging to *cupulatum.* Bridel, however, thinks differently."

The only reason for doubting whether *O. strangulatum* Beauv. is the same as Schwægrichen figured is the strangulate half-exserted capsule, as it will be seen that none of the other differences are mentioned by Beauvois. It is not impossible that *O. strangulatum*, Beauv., should be *O. Porteri* Aust., for the capsules of the latter are strangulate when old, though less so than *O. strangulatum*, Sull., but as the original description is so emphatic, and the specimens sent to Schwægrichen are none of them strangulate, it seems probable that eleven years after his description was published he might have made a mistake, and sent him a different species. Should it be proven that the specimens in the herbarium of P. de Beauvois agree with those he sent to Schwægrichen as *O. strangulatum*, then this name would have to stand for *O. Porteri* Austin, but in view of the fact that the original description calls for a strangulate capsule, and none of the specimens are strangulate, we must maintain this name in the sense in which Sullivant and all subsequent authors have used it. Bridel was the first to apply it to the tree species definitely, for in the Bryologia Universalis (**1**: 273, 1826) he says, of the habitat of this species:

"In America boreali, arborem, ut e speciminibus a D. Torrey Noveboraco missis corticique adnatis video, nec terrigenum caespitose habitat."

The "nec terrigenum" refers to the habitat given by Schwægrichen in his supplement, where he says, "probabiliter rupestre aut terrigenum." But he cites Schwægrichen's description almost word for word, describing the teeth as sixteen, whereas if the specimens sent him by Dr. Torrey were from trees they must have had eight teeth united in pairs. This does not affect the question of the name, however, though I have sent specimens of *O. strangulatum* Sull. (Beauv.?) and *O. Porteri* to Berlin for comparison with Bridel's specimens.

Braithwaite (Brit. Mosses, **2**: 77) cites *O. strangulatum* Beauv. as one of the synonyms of *O. cupulatum* Hoffm. and quotes Schwægrichen's Supplement t. LIV. also for this species. Now it seems to me that tables LIV. and LV. disprove this, for certainly the true differences between *O. cupulatum* Hoffm. and *O. strangulatum* Schwæg. are clearly figured in these two plates and show that as early as 1816 the specific value of *O. Porteri* was recognized, even though all later authors have referred it to *O. cupulatum* as a variety.

Orthotrichum stellatum Brid. Bryol. Univ. **1**: 274 (1826).

Since Renauld and Cardot have listed this name in their catalogue of mosses of North America as No. 552, and it has been omitted from all our text-books, it seems of interest to look into the matter, especially as Bridel says:

"*O. strangulato* proximum, et foliis supremis stellatis, ut et peristomii structura et calyptra glaberrima ab eo distinctum.

"Species propria esse videtur.

"In Massachusetts Americae Septriònalis ad arbores habitat. D. Torrey Noveboraco misit."

I have not been able to find any specimens in Dr. Torrey's herbarium labelled *O. stellatum*, nor *O. strangulatum*, but it seems to me the explanation is this: Dr. Torrey sent him the tree species labelled *O. strangulatum*, which on comparison with the description and plate of Schwægrichen's supplement, he saw had 8 teeth, united in pairs, and a calyptra free from hairs, so he called it *O. stellatum*, but described it with a simple peristome. As the cilia are often lacking in old capsules this would be easily explained. It will be seen that his description of *O. strangulatum* called for 16 teeth and a hairy calyptra.

In the Jaeger Herbarium I find an autograph specimen from Müller, collected by T. Boll at Cambridge, Mass., labelled *O. strangulatum*, var. *stellatum*, Brid. These specimens were examined and prove to be like *O. strangulatum* Sull. in every particular except the absence of cilia. The capsules are old and urceolate, and the calyptras are without hairs.

Of course, if it were proven that *O. stellatum* Brid. antedates *O. strangulatum* Sull. it would also antedate *O. Braunii* Br. & Sch. by eleven years, for according to Dr. Venturi (Musc. Gall. 182, 1887) "*L'O. strangulatum* Sull. de l'Amerique du Nord, publié par M. Austin, dans le Musci Appalachiani y correspond parfaitement, de sorte quc je ne doute pas de son identité avec *l'O. Braunii.*"

I have sent specimens to Berlin and asked Dr. Paul Hennings to compare Bridel's *O. stellatum* with Boll's specimens and with *O. Porteri*, as well as *O. strangulatum* Sull.

Müller in the Synopsis Muscorum 1: 702 cites *O. strangulatum* with Schwaegrichen's description and Bridel's habitat "In arboribus Muhlenberg primus legit." He cites *O. stellatum* Brid. as a synonym.

Venturi in the Muscologia Gallica (part vi. 171, 1887) says that *O. stellatum* Brid. communicated by Schrader, from North America, is allied to *O. fastigiatum*, and not to *O. strangulatum* Sull., where it has been referred, but that the specimens are too imperfect to be properly recognized. This would seem to indicate that he had seen the type. At any rate as *O. strangulatum* Sull. is a very common species in the Eastern States, and *O. fastigiatum* has only been collected in two localities around Lake Superior as far as we now know, therefore it seems most likely that the alliance indicated by Bridel himself is the correct one. The examination of the stomata alone would determine this, and they may be seen on any old capsules, for *O. fastigiatum* has superficial stomata and *O. strangulatum* Sull. has immersed.

Dr. Venturi says in a recent letter:

"Apropos of the confusion in nomenclature, it is sufficient to note that *O. strangulatum*, which originally was of the group of *Orth. cupulatum*, is in Lesq. and James' Manual identical with *O. Braunii*. In Austin's Musci Appalachiani I am certain that the specimens distributed as *O. strangulatum* are precisely *O. Braunii*, which should maintain its name, though more recent, because the original *O. strangulatum* of P. de Beauvois is a confused species."

As we have already shown, it is not proven that the original specimen of P. de Beauvois did belong to the group of *O. cupulatum*. That the plants figured by Schwaegrichen are *O. Porteri*, there can be no doubt, but the original description throws a doubt on these specimens. We admit that *O. Braunii* would antedate *O. strangulatum* Sull. by nineteen years, but *O. strangulatum* Beauv. if proven to be the same would antedate them both. That it can be proven seems more than probable, and as the herbarium of Palisot de Beauvois is preserved in the Delessert Herbarium at Geneva, I have sent specimens of both species to which the name has been applied, and asked to have them compared with the original specimens sent to Beauvois by Muhlenberg. I have also asked M. Eugene Autran to compare the specimen from the Boissier Herbarium figured by Schwægrichen with the originals.

ORTHOTRICHUM STRANGULATUM, var. Sull. Icon. Suppl. 65, *t. 47* (1874).

This variety is not referred to in the Manual. It is described by Sullivant as smaller and more rigid than the normal form, the leaves shorter and acute, the margin revolute almost to the apex, capsule oval, broader and less strangulate when dry, sub-exserted, on a long pedicel.

Hab. on trees, Put-in-Bay, Lake Erie.

ORTHOTRICHUM CUPULATUM Hoffm. Deutsch. Fl. 2: 26 (1796).

This species seems to be more rare in North America than has been supposed. After separating out *O. Porteri* and *O. Lescurii* Austin, placing Drummond's No. 152 under *O. nudum*, though the calyptras are lacking in our specimens, and splitting up No. 176 of S. & L. Musci Bor. Am. Ed. 2 into *O. nudum* and *O. Porteri*, there remain only three specimens in our herbarium which agree with *O. cupulatum*. Leiberg's from calcareous ledges around Lake Pend d'Oreille, Idaho, which agree exactly with

Limpricht's Bryotheca Silaesiaca No. 366 cited in his Laubmoose. Macoun's specimens from Arrow Lake, B. C., cited in his Catalogue as *O. nudum* var. *Rudolphianum* are also *O. cupulatum;* and Thos. Howell's collected in Oregon. Macoun's catalogue notes localities in British Columbia and Baffin's Bay. This would seem to indicate a Northern and Western range for *O. cupulatum* and throw it out of our Eastern Handbooks, therefore it is very desirable that more specimens should be collected of this species in order to determine whether it occurs within our limits.

O. SCHIMPERI Hammar, Mon. Orth. Suec. 9 (1852).

O. pumilum Dicks. Pl. Crypt. fasc. 4, 5 (1801) non Sw. (1799).

O. fallax Schimp. Syn. 264 (1860) L. & J. Man, 171 (1884).

Any one who has studied the minute descriptions of Limpricht's Laubmoose, and read Philibert's article on *O. Schimperi* and its allied forms (Rev. Bryol. 33, 1891) will realize that much more study must be given to North American specimens before we can be satisfied that we understand this species and its alliances. The group includes, besides what we have been calling *O. fallax* Sch. *O. strangulatum* (Beauv.?) Sull. *O. Canadense* Br. & Sch. *O. brachytrichum* Sch. and two varieties, *O. strangulatum* var. Sull. and *O. fallax* var. *truncatulum* Aust.

The specimens which Philibert recognizes as typical *O. Schimperi* have a smooth calyptra. American specimens have a few short hairs. Specimens distributed as *O. fallax* Sch. by Limpricht as 129b Bryotheca Silesiaca and Rabenhorst's 125b Bryotheca Europea agree with Philibert's statement that the stomata may be both open and closed on the same capsule. No American specimens that I have seen have the stomata wide open, as described by Limpricht in the Laubmoose. Our specimens also differ somewhat in the color and size of the plants, the shape of the capsule when dry, being less urceolate than European specimens, and the ridges less sharply differentiated and less highly colored, and in the size of the spores! But as they agree in all the main characters, including the very papillose teeth, and especially in the leaves, it seems a refinement of species to separate them. However, it is possible that the American specimens are another species, which has not been collected since it was described: *Orthotrichum brachytrichum* Sch.

ORTHOTRICHUM BRACHYTRICHUM, Schimp. Proc. Am. Acad. **14**: 140 (1879).

It is always well to distrust a species which has only been collected once, and to seek for the nearest allied species for which it may have been mistaken. After seeing the type of *O. brachytrichum* from Kew, and comparing it with *O. obtusifolium*, with which it had been confounded, I discovered that it belonged to the section with immersed stomata, between *O. Schimperi* and *O. strangulatum*, where it is placed in the Manual. It is so near the former that I am inclined to think they are the same species. The leaves agree in every way, not only in the specimens, but in the descriptions, and so do all the essential characters of the capsules, except that in the types of *O. brachytrichum* is perhaps a trifle longer, with a more tapering neck. The calyptra, as the name implies, has a few short hairs. The ridges of the capsules are broad and conspicuous on the mature capsules, alternating with spaces equal to or narrower than the ridges. The cells which compose them are broad yellow, in 2–5 rows, alternating with 5–6 rows of narrower cells, and agree with the figures given by Limpricht of *O. Schimperi.* The stomata are small and quite closed.

It may be that we shall conclude to call all the American specimens by Schimper's name, but I have sent specimens to both Philibert and Venturi to ask for their opinion and a further comparison with European *Schimperi.*

O. FALLAX var. TRUNCATULUM, Aust. Bull. Torr. Club, **6**: 344 (1879).

Austin lays stress on the leaves being "hyaline apiculate, the capsule cylindric and costate its whole length, abrupt at base with the cilia as long as the teeth." We have examined his type specimens collected in Illinois by Hall at the base of old buildings and find many of the leaves ending in a single clear cell, as figured by Schimper in the Bryologia Europea t. 211. The capsules however are slightly longer than in *O. fallax*, the largest 1. 5 mm. long with the lid, but the truncate base and short neck is quite characteristic of that species as well as of these specimens, and the seta immersed in and shorter than the ochrea which flares out and embraces the base of the capsule is also quite typical. The cilia are slender as long as the teeth and slightly appendiculate; but this too is found to agree with Limpricht's description of *O. Schimperi.* The calyptra has a few short hairs at apex, and on the whole the specimens agree perhaps better with *O. brachytrichum* than with European specimes of *O. Schimperi.*

ORTHOTRICHUM CANADENSE Br. & Sch. Lond. Journ. Bot. **2**: 667 (1843), non Sullivant's Mosses U. S. 34 (1856).

This species was described from Drummond's North American mosses as follows:

"149–151. *Orthotrichum affine* var. capsulis exsertis, is more nearly related to *O. patens* but differs, however from this species remarkably in its smaller capsules, which are longer pedunculated and in the rusty red-colored teeth of the peristome: it is without doubt a new species, for which we propose the name *O. canadense.* No. 149 differs from 151 only in having longer stems."

We have been favored by the Director of the Royal Botanic Gardens at Kew with the privilege of seeing a portion of the type, which is labeled "*Orthotrichum Canadense* (*O. affine* var.) Ober Canada," and matches Number 151 in our set of Drummond's mosses which is labeled *O. affine* var. capsulis exsertis (an species distincta?), Hab.—Upper Canada, and about Lake Superior; upon trees." It will be seen from the citation of the names and localities that Bruch and Schimper had reference principally to 151, and the characters of the specimens confirm this supposition. They refer to 149 secondarily and seemingly without careful comparison, for our specimens at least are not the same species as 151. The specimens from Kew as well as our 151 are older, and two out of three capsules are without peristome, but the third shows a simple peristome of sixteen striolate teeth, the capsules are exserted and the walls have eight prominent ridges, besides narrower intermediate ones. The stomata are immersed.

I do not know how to account for the intermediate ridges, on a species said to be allied to *O. patens*, for they usually indicate one of the rock species such as *O. anomalum*, but as these capsules are strangulate, smaller, and less exserted than those of that species, and furthermore were said to grow on trees, we must exclude that hypothesis. The separation of the teeth and absence of cilia may be accounted for by age, and indeed Sullivant figures them separate in the Icones, though I am not certain whether his drawings were made from Drummond's 149 or from Watson's Utah specimens. It is only an inference on my part that the Kew specimens were taken from 151, however. The resemblance of our specimens of 151 to 148 which was distributed as *O. anomalum* is very close, and the specimens are in the same stage of growth, so that it is not impossible that some specimens of the latter may have been mixed with 151 in collecting or distributing.

No. 149 in our set and Prof. Macoun's are another species. They are mature, not in that intermediate stage where the new calyptras are present with old capsules as in 151. They have the lids on in several cases, and the peristome of one of these freshly opened capsules shows the teeth united in pairs, pale white, almost smooth, but with a high magnification (300), the basal part of the teeth is granulose, and the upper segments striolate; they are more or less perforate and divided into three or four parts at apex, and the eight cilia are long and slender, with two rows of cells at base. The ridges are very broad, of 6–8 rows of cells, with very narrow spaces between them, and the stomata are immersed around the base of the spore-sac. The neck tapers into the ochrea, and the seta is short.

ORTHOTRICHUM ALPESTRE var. Sull. Icon. Suppl. 69, *t. 51* (1874).

O. alpestre var. *majus* L. & J. Man. 169 (1884).

O. occidentale James, Expl. 40th Parallel, 402 (1871).

Sulllivant cited Drummond's No. 149 as this species; also Watson's specimens from Utah. He says of it that it differs from the normal form of *O. alpestre* in its greater size, glaucous green color, broader leaves with more reflexed margins, more elongated papillæ, either simple or bifurcating, and the longer and minutely punctulate teeth. In Limpricht's Laubmoose I find that *O. alpestre* is described as an alpine rock species, with the teeth distinctly striolate and perforate, united to apex, cilia 8 of two rows of cells and appendiculate. Drummond's 149 agrees very well with the description, though the teeth are less distinctly striolate than indicated by Limpricht, but the habitat is according to the label, on trees, not on rocks.

Watson's Utah specimens grew on trees also, as shown by the original specimens, recently seen in the Sullivant herbarium. The Icones cites them as growing on rocks. We sent a portion of 149 to M. Philibert and he says they agree with European specimens of *O. alpestre* in his collection. Specimens collected by R. S. Williams, No. 96 and distributed *O. alpestre* var. *majus*, grew on rocks, in the Belt Mountains, Montana, and were sent to Venturi for comparison. He says they are *O. alpestre*, and the most extreme form he has seen in its differences from *O. stramineum*, to which *O. alpestre* is closely allied.

Noticing that Limpricht cites the locality of this species as on trees and *O. alpestre* on rocks, we tried to refer No. 149 to the former, but we could not find any intermediate cilia.

It will be seen, therefore, that both *O. Canadense* and *O. alpestre*, var. Sull., stand on very uncertain foundations, and require more study to settle the question of their value. *O. Canadense*, especially, based on two numbers of exsiccatæ, which are more or less mixed and imperfect, with such a meagre description, can hardly be said to be a well established species. Prof. Macoun's specimens of No. 151 do not show any intermediate ridges and do not agree exactly with the Kew specimens or with 149; the capsules are older than 149, are less strangulate, and the peristome is gone, so that they do not help us to solve the riddle, and only complicate the question of what is *O. Canadense?*

We have received specimens from Prof. Macoun which agree with 149, but he is uncertain whether he collected them on rocks or trees. They are mixed with *Grimmia apocarpa*, but the label says on trees near Ottawa. It will be noted that No. 149 of Drummond's mosses is cited in the Catalogue as No. 338, *O. alpestre*, (p. 88), and again with 151 as No. 361 *O. Canadense* (p. 92). Mr. Wright informs me that there are specimens at Kew, collected by Prof. Macoun on trees along the Moira at Belleville in 1865, labelled *O. Canadense* by Mitten.

ORTHOTRICHUM TENELLUM Bruch, Brid. Bryol. Univ. **1** : 786 (1826).

Specimens collected on trees by J. Dearness, near Ottowa, in May, 1889, are credited to this species in Macoun's catalogue (6, 90). I have seen the specimens and compared them critically with European descriptions and exsiccatæ. They are not *O.*

tenellum, but agree in every way with what we have been calling *O. strangulatum* (Beauv.?) Sull. We have recently received from S. B. Parish specimens collected in California, which do agree with the descriptions and specimens in all but the cilia, and they are not papillose as Limpricht described them. *O. tenellum* is one of the few species of *Orthotrichum*, which have the stomata in the neck of the capsule and not around or above the base of the sporesac, and hence it is readily recognized.

ORTHOTRICHUM PUMILUM, AMERICANUM Vent. Musc. Gall. 180 (1887).

Orthotrichum pumilum Sw. fide Austin Musci App. 165 (1870).

O. fallax Sw. fide Austin, Bull. Torr. Bot. Club, **6**: 344 (1879).

We have examined the specimens in our set of Austin's Musci Appalachiani, and compared his specimens with European specimens of *O. pumilum*. They are not that species, and we have not yet been able to find the specimens that Venturi referred as a variety to *O. pumilum*. The figure given by him indicates that his capsules were much shorter than any European specimens (T. xlix. 15a), and from the following description it would seem as if he had reference to *O. Ohioense*, which I find mixed with our specimens.

" *Var. Americanum:* Tufts small, lax, soft; leaves almost without papillæ, capsule with 8 bands, composed of two series of rectangular cells, feebly differentiated, teeth 8, obtuse perforate along the median line, finely papillose."

I find that Austin was right in citing his 165 as *O. fallax* Sch. (non Sw.) as most of it is that species, and may be readily recognized by its short capsules with abrupt neck immersed in the ochrea, and serrulate leaves. The perforate teeth of *O. Ohioense* gave rise to a manuscript name in Austin's herbarium, *O. perforatum*, which he afterwards published as *O. citrinum*. Sullivant figured *O. Ohioense* with entire teeth.

ORTHOTRICHUM OHIOENSE Sull. & Lesq. Musci Bor. Am. Ed. 2, 181.

Orthotrichum citrinum Aust. Musci App. 170 (1870).

Orthotrichum Ohioense var. *citrinum* (Aust.) L. & J. Man. 171 (1884).

At first sight it would seem desirable to maintain *O. citrinum* at least as a varietal name, but in carefully examining authentic specimens of Sullivant's and Austin's I found that when they were in their prime, with the capsules mature or just after sporosis, they agreed with *O. Ohioense;* when old and shriveled they agreed with *O. citrinum.* In fact, I found that both were mixed in the same patch, and as in all species of *Orthotrichum* the capsules are very different in different stages, so this seems to be only another instance of the elongation of the neck, and shrinking between the ridges after sporosis. The teeth at first are united in pairs, but later become perforate and then divide. The mouth is bordered by irregular round cells, and the ridges are short, and narrow when the capsule is ripe and inflated, varying from 2–4 rows of cells; the two inner are usually broader and more oblong than the two outer, though all four are usually bright yellow in the mature capsules, and only the two inner turn brown in the old wrinkled capsules. The stomata are very conspicuous in this species, owing to the projection of the cells which surround them and are usually about midway between the base of the spore-sac and the mouth. The calyptra and vaginule are hairy, the ochrea in the mature capsule is longer than the seta and clasps the broad base of the capsule, but with the elongation of the neck and seta it shrinks away.

ORTHOTRICHUM PSILOTHECIUM C. M. & Kindb. Macoun's Cat. 6, 91 (1892).

This species is founded on the slimmest of specimens according to the description, as the authors state that they "have not been able to examine the peristome nor the stomata of the capsule, because only one capsule (in our specimens) is nearly ripe, the others quite unripe."

Now a species of *Orthotrichum* without the stomata described, nor the peristome, is worse than useless, as in this genus the leaves are almost alike in nearly all the species.

We have been favored with a portion of the Rockcliffe specimens by Prof. Macoun, but have not seen the two others cited in the catalogue. The Rockcliffe specimens agree with the description and are still immature as is stated, but we found two old capsules which prove them to be *Orthotrichum strangulatum* Sull. beyond a doubt. The description of the calyptra would indicate this, but these capsules prove it, for they are constricted below the mouth, with brown ridges and immersed stomata, and reflexed teeth, united in pairs.

ORTHOTRICHUM PUSILLUM Mitt. Journ. Linn. Soc. **8**: 25 (1865).

O. psilocarpum James, Trans. Am. Phil. Soc. **13**: 110 (1869).

From the remarks in the manual it will be seen that James admitted the above synonymy, but took exception to the capsule being described as 8-plicate when dry, yet in consulting his original description I find the following remarks:

> "This species differs from *O. Canadense* by the smooth capsule, although at times it appears striate when empty, the capsular walls are nevertheless equal and not at all different at the apparent striæ, which are produced solely by desiccation."

(The *O. Canadense* referred to is not Schimper's of 1843, but Sullivant's of the Mosses of the U. S., page 33, 1856 = *O. Ohioense.*)

On examining S. & L. Musci bor. Am. 180 I find that the walls of the capsules, though generally smooth when dry, do show faint traces of the differentiation of the walls into ridges, and in fact 3–4 rows of cells are often longer, thicker and narrower, alternating with broad spaces of short quadrangular cells.

The original description by Mitten calls for one of Drummond's mosses from Pennsylvania. I find that Number 82 in his second set (1841) distributed as *O. affine* var. *pumilum* contains specimens of *O. psilocarpum* James, mixed with *O. strangulatum* Sull. The description does not cite any number, but this must be the one referred to, as the locality agrees. Sullivant in the Icones Supplement says:

> "Mitten's character of *O. pusillum* 'Theca siccitate 8-plicata' does not agree with this species, in which the capsule is neither plicate nor striate. It represents apparently a different species found intermixed with *O. psilocarpum*. Specimens communicated by the English author, however, truly represent this last species."

Now the explanation of that troublesome quotation is that although Mitten made a mistake in describing the capsule of another species, probably *O. strangulatum*, yet most of his description and his specimens show that he recognized his species as distinct. According to the laws of nomenclature, his name must stand, and the main part of his description, for even his mistake is not a bad one, as the capsules are occasionally faintly 8-ribbed when dry.

In some few cases the outlines of the guard cells are visible in this species; one stoma was seen which appeared superficial, all the rest on the same capsule were immersed. Venturi in the Muscologia Gallica says of *O. psilocarpum*, that it is a singular species, which unites the characters and smooth capsule of *O. leiocarpum*, with the section having immersed stomata. In fact it is with *O. striatum* (*O. leiocarpum*) that it is liable to be confounded, but it may readily be distinguished by the absence of the broad erose cilia.

Studies in the Botany of the Southeastern United States—I.

By John K. Small.

(Plates 170, 171.)

Having taken up the flora of the Southeastern United States as a special field of study in this and the papers to follow, entitled *Studies in the Botany of the Southeastern United States*, I intend to put on record facts concerning the plants of that very interesting region not yet made known, with a view to more extended and connected work when the field has been better explored. The papers will include, for the most part, descriptions of and notes on new species and additions to our flora; also remarks on native and introduced plants, facts concerning geographical and altitudinal distribution, and the relations between the geological formations and certain specics. This latter side of botany, much neglected in the past, is exhibited in a striking manner in portions of the Southern States. The sources from which the following contributions are derived are my own collections in the South and the vast amount of material preserved in the Columbia College Herbarium, which includes, besides many types and specimens of the early Southern botanists, the very valuable herbarium of Dr. Chapman, and these sources will be augmented by the collections of local botanists who have promised to coöperate with me.

ASPLENIUM BRADLEYI D. C. Eaton, Bull. Torr. Club, 6: 11 (1873).

Contrary to its usual habitat, which is perpendicular or overhanging and rather damp, disintegrating cliffs, Asplenium Bradleyi was found growing on horizontal, moss-covered granite rocks at the northern base of Stone Mountain, De Kalb county, Georgia, in April, 1893, altitude 1,000 feet.

Until lately this fern was one of those noted for its restricted geographical and geological range. Now it is seen to have an extensive and interesting distribution. The boundary of its area appears to be from Eastern New York to Kentucky, Tennessee and Arkansas to Middle Georgia, and north to Southeastern Pennsylvania. In Kentucky, Tennessee and Arkansas, the original localities, it was confined to the limestones and sandstones. In Southeastern Pennsylvania, where the best developed and most beautiful specimens have been found, some measuring almost one foot in length, it occurs on the rotting schistose rocks of the Lower Susquehanna Valley. In Middle Georgia we have it from the hard, white granite.

MELIA AZEDERACH L. Sp. Pl. 384 (1753).

"The Pride of India or China-Tree (*Melia Azederach* L.) belongs to an allied order MELIACEÆ." This statement we find in Chapman's Flora of the Southern United States. Having no position assigned to it in the Flora, we infer that at the time of publication this plant had not yet established itself in our country, but was perhaps frequent in cultivation throughout the extreme Southeastern States. Now the species is thoroughly naturalized in Middle and Southern Georgia and very likely in all the surrounding territory. During the past season I collected fruiting specimens near the base of Little Stone Mountain, De Kalb county, and at several localities on the rocky banks of the Yellow River in Gwinnett county. The prevailing common name in Middle Georgia is "China-berry."

BAPTISIA SERENÆ M. A. Curtis, Amer. Journ. Sci. (I.) 7: 406 (1845).

From the general appearance and acccording to Mr. Canby's key to the species of the genus *Baptisia* (Bot. Gaz. 4: 131) my Georgia specimens belong to the above. Heretofore it seems to have been known only from the region about Society Hill, South Carolina, where Mr. Curtis first collected it. While traveling between Toccoa Falls and Tallulah Falls, in Habershan county, Northern Georgia, I found the plant scattered quite plentifully through the open woods on mountain sides. Before August 8th, all the plants had matured their fruit and no flowers were secured.

AMORPHA VIRGATA n. sp.

Perennial, nearly glabrous, sometimes slightly glaucescent. Stems one or several from a woody base, 1–2 meters tall, erect or nearly so, rather stout, simple or branched only at the summit, wand-like, dark purple-green, more or less channeled, leafy only at the summit; leaves 8–16 cm. long, 6–8 cm. broad, leaflets 11–19, oblong, oblong-ovate or ovate, 2–5 cm. long, 1–2 cm. broad, mostly opposite, on petiolules 2–3 mm. long, emarginate and often apiculate by the excurrent mid-rib, obtuse or cordate, and unsymmetrical at the base, prominently nerved beneath, pubescent about the nerves on the under surface, rather dark but bright green above, brown beneath, very coriaceous and firm; inflorescence consisting of one or several narrow racemes, confined to the summit of the wand-like stems; racemes 8–15 cm. long (in fruit); calyx obconic-campanulate, 3 mm. long (in fruit), pubescent with a few spreading hairs, arranged in quite regular groups of 3–5, the three dorsal teeth acute, the two ventral teeth obtuse and rounded; pediceles short, inclined to separate at the proximal articulation; legume one-seeded, 7 mm. long, 3–4 mm. broad, *straight along the dorsal suture*, much curved along the ventral suture, resinous dotted, dorsal suture distinctly margined; persistent style attached, apparently, above the beak; seed ovoid, laterally compressed, inconspicuously beaked, about one-half as broad as long, with a lateral impression near one or both ends. (Plate 171.)

Found only on the northern and western slopes of Stone Mountain, De Kalb county, Georgia. Fruiting in July. It is apparently restricted to a narrow belt ranging from 1,100–1,200. feet above the sea level, and grows in a few places where the granite rocks are flat enough to hold a layer of sand. A striking species, remarkable in general appearance for its wand-like form, in particular parts for the dry, coriaceous leaves, the straight dorsal edge of the legume, and the single thick, ovoid seed with the impression near one or both ends. *A. fruticosa* is usually much branched throughout, of a lighter green color, with mostly membranaceous leaves, the legume *much curved on the dorsal edge*, with one or two narrowly or linear-oblong seeds, usually marked with an impression near the middle.

AMYGDALUS PERSICA L. Sp. Pl. 472 (1753).

In the past there have been many oversights and even a certain amount of narrowness in regard to foreign plants which have had a perfect right to become members of our naturalized flora, and which should have been recognized in our botanies. The above-named plant belongs to this class. It has doubtless been naturalized for many years, and now one meets with it throughout the Eastern United States. During the past season it was noticed at numerous localities in Middle Georgia, and was collected on the dry, rocky slopes of Stone Mountain, De Kalb county, early in July, at the altitude of 1,200 feet, well established and producing abundant fruit.

LAGERSTRŒMIA INDICA L. Sp. Pl. Ed. 2, 734 (1762).

This very ornamental shrub has long been cnltivated in gardens from Southern Virginia southward. Dr. Chapman gives it no place in the Southern flora, but prints this note: "The Crape Myrtle (*Lagerstrœmia Indica* L.) originally from Eastern Asia, is common in cultivation."* The species is now well established about Stone Mountain, De Kalb county, Georgia, and blooms in the middle part of the State at an elevation of 1,000 feet about the second week in July. This species has long been cultivated in South America, but according to Dr. Morong's observations it has not yet become naturalized in Paraguay.

NYSSA BIFLORA Walt. Fl. Car. 253 (1788).

Grows on the very summit of Stone Mountain, De Kalb county, Georgia, altitude 1,686 feet. It is remarkable that this tree usually confined to the seacoast or seaboard, from Southeastern Virginia southward, should occur in the above situation. There are a number of trees on the small dome-like top of the mountain, and they seem to flourish, although somewhat worn and torn by the heavy winds which sweep by their exposed habitat, and thrive notwithstanding the fact that they grow in but a few inches of sand collected in depressions of the hard granite rock.

GAYLUSSACIA DUMOSA (Andr.) T. & G.; A. Gray, Man. 259 (1848).

In 1891 the geographical and altitudinal range of this "coast" plant received a surprising extension by its discovery on a hillside near Hickory, in Western North Carolina, at an elevation of nearly 2,000 feet. (Mem. Torr. Club, **3**: 8.) During the season just past, while exploring in the vicinity of Tallulah Falls, Georgia,

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* Flora Southern U. S., 135.

I came upon great quantities of this species growing on the dry sand and quartzite hills north of the deep cañon of the Tallulah River, in Rabun county, at an altitude varying from 1,600 to 1,800 feet. Somewhat later, on a trip to the source of the Tallulah River, it was collected on the lower sandy slopes of the Thomas Bald, a high mountain on the North Carolina and Georgia boundary. There it ranged from 2,500 to 3,000 feet, and was scattered through the forests, at some places in great abundance, and grew vigorously, apparently none the worse for its separation from the influences of the coast.

The first record of the occurrence *Gaylussacia dumosa* at an appreciable distance from the seacoast seems to be in Prof. Porter's Catalogue of the Plants of Lancaster County, Pa. (Mombert's History of Lancaster County, Pa., p. 590). Prof. Porter found it in that section in a swamp, remarkable for its peculiar plant life, near Smithville. Mr. J. J. Carter encountered it somewhat later in a swamp bordering on the Serpentine Barrens, in the southern part of the same county.

The most interesting and striking fact suggested here is this: At the Pennsylvania localities the plant grows in swamps, and at Smithville is actually in the water, whilst in the mountains of North Carolina and Georgia, as far as I have observed, it selects the driest situations afforded.

RUBUS MILLSPAUGHII Britton, Bull. Torr. Club, **18**: 366 (1891).

Grows on the walls of the cañon at Tallulah Falls, Georgia Collected in flower in April, 1893. Altitude 1,600 feet. This most likely locates the southern limit of the geographical range of *R. Millspaughii.* Being a typically high mountain species, it is not to be expected much below 1,600 feet, and just south of the above mentioned locality the Blue Ridge "runs out" into the plains. Further south the land decreases gradually in altitude until the gulf is reached. According to my observations the above plant thrives most vigorously at altitudes ranging from 4,500 to 6,000 feet. It grows well at lower elevations, but never in such a prolific manner.

ERIGERON NEO-MEXICANUS A. Gray, Proc. Amer. Acad. **19**: 2 (1879).

Collected in Burnet county, Texas, in August, 1892, by F. G.

Schaupp. This discovery adds one of the species of the flora of Arizona and New Mexico to that of the Southeastern United States. An interesting leap from the plains of New Mexico to the valley of the Colorado River is Middle Texas.

HIERACIUM SCRIBNERI n. sp.

Annual or perennial, somewhat glaucescent throughout. Stem 4–5 dm. tall, erect, sparingly or diffusely branched above, leafy throughout, glabrous or somewhat pubescent below, with long, spreading, silvery hairs, often glaucous, more or less channeled and flexuous; peduncles and pedicels glabrous or densely glandular; leaves diverse in form, the lowest oblong or oblong-spatulate, 5–8 cm. long, on winged petioles, acute, acuminate at the base, the remaining oblanceolate, oblong, narrowly or linear-lanceolate, 4–12 cm. long, sometimes even fiddle-shaped, sessile or inclined to be decurrent, acute, all nearly glabrous on both surfaces, with a few scattered spine-like teeth, between which on and near the margin are few or numerous spreading silvery hairs; inflorescence more or less corymbose-paniculate; heads large, bright yellow, 2–2½ cm. broad; involucre nearly glabrous or glandular; principal bracts 1 cm. long, linear-subulate, acuminate, sometimes dilated at the base, smaller bracts ½–⅓ shorter; achene columnar, sometimes slightly constricted under the inconspicuous rim at the summit, rather inconspicuously ribbed; ribs barbed upward; pappus not exceeding the involucral bracts, rather light colored. (Plate 172).

Collected on Lookout Mountain, Tennessee, May 21, 1890, by Prof. F. Lamson-Scribner. Notwithstanding the early date the plants are mature and bear plenty of ripe achenes.

The specimens on which the above species is founded were distributed as *Hieracium paniculatum*, which species, however, it does not very closely resemble. It is more nearly related to *H. venosum* or *H. Marianum*, although abundantly distinct from either. From the former species it may be separated on sight by the leafy stem and pappus shorter than the principal involucral scales (in *H. venosum* the pappus is longer than the principal scales of the involucre, an important and striking character which seems to have been overlooked); from *H. Marianum* it differs in the more leafy stem and the usually diffuse, leafy branches.

Plants from Virginia new to Gray's Manual Range, with Notes on other Species.

By A. A. Heller.

Virginia, since its southern boundary is also the southern boundary of our Northern flora, is a state of peculiar interest to the botanist; but notwithstanding this fact very little work has been done in the way of systematic exploration until the last year or two, and the result has been surprising, considering the limited area that has been covered.

My own work during the past summer (1893) was confined principally to its southeastern corner, in the region of Franklin, Southampton county, a town of about 1,500 inhabitants, situated at the head of tidewater on the Blackwater River, and thirty-seven miles west of Norfolk. Several trips were made to the vicinity of Virginia Beach, a resort on the coast, eighteen miles east of Norfolk, and a few to points near Franklin. A few days in May and August were spent in the western part of the State, in Rockingham and Augusta counties.

All that portion of the State lying east of the Blue Ridge as far as the Peaks of Otter, and from there north and west, with the exception of the southeastern corner—and that still needs considerable attention—is practically unexamined.

The following results of a rather hurried summer's work, will show what awaits more thorough scrutiny:

ASPLENIUM EBENOIDES R. R. Scott, Journ. Roy. Hort. Soc. 87 (1866).

Collected near Mt. Crawford, Rockingham county, on limestone rocks, at an elevation of 1,400 feet. *Asplenium parvulum* and *Camptosorus rhizophyllus* are both plentiful and growing in company. My first impression was that if our plant is a hybrid, a new combination had been discovered. But close scrutiny revealed a withered frond of *A. platyneuron* just above, and almost touching the *A. ebenoides.* Thus another station and state is added to the known geographical distribution of this rare fern.

PANICUM GIBBUM Ell. Bot. S. C. & Ga. **1**: 116 (1817).

This southern grass, collected at Virginia Beach, Princess Anne county, by Dr. Britton and Mr. Hollick (Mem. Torr. Club, **2**: 54), was again collected there on the 7th of September, on the margin of the pond on the lower side of the railroad. All specimens of this plant which have come under my observation, with one exception, have been collected near the coast. The exception is from Messrs. Beardslee and Kofoid, collected in the Great Smoky Mountains, Swain county, N. C., at an elevation of 1,800 feet.

IRIS GERMANICA L. Sp. Pl. 38 (1753).

This European Iris was collected in a little grassy meadow on the banks of the north fork of the Shenandoah River, about one mile north of Cave Station, Rockingham county, May 13th. It has been there for a number of years, and is well established. The nearest house is about one-fourth of a mile distant.

ANEMONE TRIFOLIA L. Sp. Pl. 540 (1753).

On the peak of Massanutten Mountain, Rockingham county, at an elevation of 2,900 feet, growing in dry rocky ground. This point is about seventy-five miles north of the Peaks of Otter, where members of the Torrey Botanical Club collected the plant several years ago. Collected May 9th. One week later it was found in a dry ravine at White Sulphur Springs, W. Va., at an elevation of about 2,300 feet. The latter situation is less exposed than the former, and the plants more robust.

RANUNCULUS OBLONGIFOLIUS Ell. Bot. S. C. and Ga. **2**: 58 (1821).

Collected in Isle of Wight county, near the abutments of the Atlantic and Danville R. R. bridge over the Blackwater River at Franklin. The northern range of this plant is given in the Sixth Edition of Gray's Manual as Illinois and Missouri.

CROTALARIA ROTUNDIFOLIA (Walt.) Poir. in Lam. Encycl. Suppl. **2**: 402 (1811).

Anonymos rotundifolia Walt. Fl. Car. 181 (1788).

Crotalaria sagittalis var. *ovalis* Michx. Fl. Bor. Am. **2**: 55 (1803).

Crotalaria ovalis Pursh, Fl. Am. Sept. **2**: 469 (1814).

In a sandy field about one mile east of Suffolk, Nansemond county. Collected in flower and young fruit, June 8th. Previously recorded only from the Southern States, Chapman giving its range from North Carolina to Florida.

Zornia bracteata (Walt.) Gmelin, Syst. **2**: 1096 (1796).

Anonymos bracteata Walt. Fl. Car. 181 (1788).

Zornia tetraphylla Michx. Fl. Bor. Am. **2**: 76 (1803).

Hedysarum tetraphyllum Poir. in Lam. Encycl. **6**: 405 (1804).

Plentiful in a dry sandy field at Franklin, Southampton county, in the rear of the "peanut factory." Previously cited range, Florida to North Carolina and westward.

Meibomia rhombifolia (Ell.) A. M. Vail, Bull. Torr. Bot. Club, **19**: 113 (1892).

Collected at Northwest, Norfolk county, September 6th. The plant is referred to this species with some doubt, but agrees with a glabrous form collected in Louisiana by Dr. Hale.

Cyrilla racemiflora Walt. Fl. Car. 103 (1788).

Collected on the edge of a swamp at Franklin, Southampton county, June 29th. Also observed at several other localities near the railroad. Known before from the coast region of the Southern States, all the herbarium specimens seen by me being from Florida.

Linum Floridanum (Planch.) Trelease, Trans. St. Louis Acad. **5**: 13 (1887).

Prof. Trelease doubtfully records this species from S. Illinois. It also appears to be scattered all over Southern Virginia, as it was collected at five different stations, representing the whole southeastern part of Virginia.

Lechea Torreyi Leggett, Bull. Torr. Club, **6**: 250 (1878).

Hitherto unrecorded from the northern range, this plant grows rather abundantly in a strip of grassy woods between the tracks of the Atlantic and Danville and the narrow gauge railroad, at Suffolk, in company with *L. racemulosa.* It was also collected on the southern boundary of Virginia, near Margarettsville, N. C.

In Isle of Wight county a *Gaylussacia* (No. 992) was collected, which, although related to *G. resinosa*, seems to be distinct. It is seldom more than sixteen inches high, very strict from a creeping base, and the fruit is invariably clustered on the main stem, generally below the leaves. Berry glossy red-black, without bloom, insipid.

A *Vaccinium* (Nos. 980 and 995) does not answer to any of our described species. The two are different in habit, but evidently the same species. No. 995 is a low bush not over a foot high, while 980 is a large spreading bush, with wand-like branches, six or seven feet high. Collected June 14th, near Franklin, in fruit only. Without flowering specimens, I will not venture to assign a specific to either this or the *Gaylussacia*.

VACCINIUM ATROCOCCUM (A. Gray).

Vaccinium corymbosum var. *atrococcum* A. Gray, Man. Ed. 2, 250 (1856).

This plant, long since proved to be a very distinct species, must bear the name given above, all the others with which it has been associated at different times being homonyms.

GALAX APHYLLA L. Sp. Pl. 200 (1753).

We are often surprised at finding coast plants growing upon the higher mountain tops of the South, but here is a reversal of affairs. On June 8th this plant was collected about two miles east of Suffolk, Nansemond county, less than forty miles from the extreme coast line of Virginia. The list of elevations of the N. and W. R. R. give Suffolk as 53 feet above sea level. According to my own observations in the mountains of North Carolina, the plant hardly descends to 2,000 feet, and is most abundant at about 4,000, rarely being found much higher. Wherever *Galax* occurs to any extent, there is a peculiar odor, somewhat suggestive of polecats. This odor was very noticeable at the Suffolk station.

ASCLEPIAS INCARNATA L., forma ALBIFLORA.

In a meadow at Mt. Crawford, Rockingham county, were several plants with white flowers. They were growing at some distance from any having flowers of the ordinary color, and were lower, stouter and more spreading. Altitude, 1,300 feet.

SABBATIA CALYCINA (Lam).

Gentiana calycina Lam. Encycl. **2**: 638 (1786).
Chironia dichotoma Walt. Fl. Car. 93 (1788).
Chironia calycosa Michx. Fl. Bor. Am. **1**: 147 (1803).
Sabbatia calycosa Pursh, Fl. Am. Sept. **1**: 138 (1814).

At Franklin, in swampy ground, but not plentiful.

KOELLIA ALBESCENS (T. and G.) Kuntze, Rev. Gen. Pl. 520 (1891).

Pycnanthemum albescens (T. and G.) Amer. Jour. Sci. **42**: 45 (1842).

Collected in low, sandy ground on the southern boundary of Virginia, near Margarettsville, N. C. "Alabama and Florida and Texas" was its formerly accredited range.

DIANTHERA OVATA Walt. Fl. Car. 63 (1788).

Justicia humilis Michx. Fl. Bor. Am. **1**: 8 (1803).

Rhytiglossa oblongifolia Nees in D. C. Prodr. **11**: 338 (1847).

Rhytiglossa humilis Nees in D. C. Prodr. **11**: 340 (1847).

Dianthera humilis Engelm. and Gray, Bost. Journ. Nat. Hist. **5**: 230 (1845), name only.

In a swamp at Franklin, Southampton county. Collected June 17th, nearly all the specimens being in fruit. Its range, as given, has been "S. Carolina near the coast to Texas." As shown by examination of the Boston Journal of Natural History, in which the Plantæ Lindheimerianæ is published, *Dianthera humilis*, Engelm. and Gray, is a *nomen nudum*, this being all that is said: "159. Dianthera humilis. In clear water. June."

NAMA QUADRIVALVIS (Walt.) Kuntze, Rev. Gen. Pl. 435 (1891).

Hydrolea quadrivalvis Walt. Fl. Car. 110 (1788).

Hydrolea Caroliniana Michx. Fl. Bor. Am. **1**: 177 (1803).

Collected in wet ground on the southern boundary of Virginia (Southampton county), near Margarettsville, N. C., on the northern border of its range, which is given as "N. Carolina to So. Florida and Louisiana?" Kuntze, in his Revisio Generum Plantarum, cites both *quadrivalvis* and *Caroliniana* as distinct species, whereas we have considered them names for the same plant. Michaux in his Flora cites *Hydrolea quadrivalvis*, Walt., as a synonym of his *H. Caroliniana*. If they are two distinct species we do not seem to have the material in this country to substantiate it.

PENTSTEMON SMALLII, n. sp.

Perennial, 1°–4° high; stem simple, leafy throughout, glabrous below, sometimes slightly pubescent above; root-leaves oval or ovate, considerably smaller in proportion than the cauline; cauline leaves opposite, lanceolate or ovate-lanceolate, 2′–5′ long, 1′–3′ wide, sessile, almost connected at the clasping, heart-shaped base, thin, divaricate, smooth on both sides, serrate with short spreading teeth, or the upper pair almost entire; inflorescence an open thyrsus, secund, the long peduncles as well as the pedicels and lanceolate bracts more or less glandular-pubescent; pedicels as long or slightly longer than the capsule; calyx-lobes lanceolate, half to two-thirds the length of the tube of the corolla, usually somewhat pubescent or glandular, scarious-margined; corolla large, 1¼′ long, ½′ or more wide, bright pink purple, with whitish stripes on the inside, abruptly tubular-campanulate above the tube proper, gibbous on the upper side, sometimes resinous-dotted, the upper lip entire, a third shorter than the three-lobed lower one; lower lip densely bearded within with yellow hairs, especially above; sterile stamen bearded to the base with yellow hairs, very densely so above; capsule ovate, mucronate, tipped by the stiff base of the persistent style, which in dehiscence splits into four parts, each tipping a segment of the capsule.

Collected by the writer on Blowing Rock Mountain, Caldwell county, N. C., July 21, 1890, at an elevation of 4,000 feet. Only two or three flowers were seen, but good fruiting specimens obtained. Early in June, 1891, the locality was again visited in company with Mr. John K. Small, to whom the plant is dedicated.* A few plants were also observed at one place along the road between Blowing Rock and Linville. Fresh specimens were again obtained at Blowing Rock during the past summer. Mr. Thomas Hogg has collected it at Asheville, N. C., and Prof. F. Lamson-Scribner at Knoxville, Tenn., where it grows from crevices of rocks along the river banks.

UTRICULARIA JUNCEA Vahl, Enum. 1: 202 (1804).

Utricularia personata LeConte, Ann. Lyc. N. Y. 1: 77 (1824).

Collected August 22d, in wet ground a short distance from the beach, just north of the Life Saving Station south of Virginia Beach, Princess Anne county. Its cited range is from "E. North Carolina to Texas."

SOLIDAGO MONTICOLA T. and G.; Chapm. Fl. S. States 209 (1860).

This has been considered a rare plant, and specimens are rare in herbaria. In Western Virginia, on Mt. Rogers (Elliott's Knob) Augusta county, it is very plentiful, ranging from 2,000 feet at the foot to 4,000 near the summit. It is most plentiful between 3,500 and 4,000 feet, and was not found on the summit, which is

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* Mem. Torr. Bot. Club, iii. No. 1, 4 (1892).

4,473 feet above sea. In western North Carolina it was observed from elevations of 2,000 to 4,000 feet. It was confined, as far as noticed, to edges of woods and thinly timbered woods, where the underbrush is scattered. On Elliott's Knob, at the places where it is most plentiful, the woody growth is composed almost entirely of *Vaccinium Pennsylvanicum* and a stunted form of *Quercus ilicifolia* about two feet high.

SOLIDAGO BUCKLEYI, T. and G. Fl. N. A. **2**: 198 (1841).

This is one of the most interesting additions to the northern flora. Collected on the Peak of Massanutten Mountain, Rockingham county, August 15th, altitude 2,900 feet. It is abundant, but only on the backbone of the ridge, and very little of it was in flower at that time. Associated with it was a slender, almost glabrous form of *S. bicolor.*

HELENIUM TENUIFOLIUM Nutt. Journ. Acad. Nat. Sci. Phila. 7: 66 (1834).

Collected at Norfolk, September 23, 1892, where there was quite a patch of it near the N. and W. yards. A few plants were observed early in the past summer, but none collected. Its first appearance so far north and east.

New or noteworthy North American Phanerogams—VIII.

BY N. L. BRITTON.

(PLATE 173.)

PICEA RUBRA (Lamb.) Link, Linnæa, **15**: 52 (1841).

I have lately been much interested in the Spruces, and have observed them closely on the Blue Ridge in Southwestern Virginia, where I became familiar with two species, one of which I supposed to be the White Spruce, *Picea Canadensis.* The same two species occur on the slopes of Mounts Marcy and McIntyre, in the Adirondacks, but neither of them is *P. Canadensis*, which species I did not see. It is reported from Northern New York, but I did not encounter it.

The two species of the Blue Ridge and the Central Adirondacks are the Black Spruce, *P. Mariana*, and the Red Spruce, *P.*

rubra. By most recent authors the latter has been regarded as a variety of the former, but this view has been ably attacked by Prof. George Lawson in a paper on "Remarks on the Distinctive Characters of the Canadian Spruces," published, I think, in 1888. He there maintains that the Red Spruce is distinct from the Black, and I am in entire accord with this opinion. The White Spruce is very different from either of the others by its elongated cones, entirely glabrous and glaucous twigs and sterigmata, and very light green leaves. *P. rubra* differs from *P. Mariana* by its very slender twigs, which are sparingly pubescent, the sterigmata nearly or quite glabrous, its very slender light-green, nearly straight, very acute leaves, and its oblong cones, which are deciduous at the end of the season, the scales lacerate or 2-lobed. *P. Mariana* has stout, very pubescent twigs and sterigmata, stout and thick, merely mucronate, dark green, incurved leaves, and ovate, larger cones, which are persistent for two or more years, their scales entire or merely erose. *P. rubra*, according to my observations, reaches a much greater altitude on McIntyre than does *P. Mariana*, and this agrees with our collections in the Blue Ridge of Virginia. The very slender twigs of *P. rubra* and its light green leaves give it a much more graceful aspect than is exhibited by *P. Mariana.*

CYPERUS RIVULARIS Kunth, Enum. **2**: 6 (1837).

Cyperus diandrus var. (?) *castaneus* Torr. Ann. Lyc. N. Y. 3: 252 (1836).

Having recently had occasion to reëxamine certain species of the genus *Cyperus*, in view of the publication of the new List of Northeastern American plants, prepared for the Botanical Club of the American Association for the Advancement of Science, I conclude that this plant is specifically distinct from *C. diandrus*, Torr. I am strengthened in this view by a note received from Mr. Coville in May, 1890, in which he emphasizes the characters adduced by Torrey in 1836. These are concisely as follows:

C. rivularis: Scales of the spikelets firm, smooth, shining; styles not at all or scarcely exserted.

C. diandrus: Scales membranaceous, usually slightly wrinkled, dull; styles conspicuously exserted.

The color of the scales varies in both species from light green to dark brown, and hence cannot be relied on for a character.

Mr. Clarke, in his paper on the Cyperaceæ of the Calcutta Herbarium maintains the two as species, but I had never been able to come to this view until I had critically observed the plants growing.

CYPERUS PSEUDOVEGETUS Steud. Syn. Pl. Cyp. 24 (1855).

Cyperus virens A. Gray, Man. Ed. 2, 493 (1856), not Michx.

Cyperus Luzulæ, var. *umbellulatus* Britton, Bull. Torr. Club, **13**: 208 (1886).

Cyperus calcaratus Nees; S. Wats. in A. Gray, Man. Ed. 6, 570 (1890).

This is clearly the synonymy of the common marsh *Cyperus* of the Southeastern United States, which I took to be a variety of the Tropical American *C. Luzulæ* Rottb. The name *calcaratus* first appears in print by Bœckeler (Linnæa, **35**: 558 (1867–68)), where it is cited as a synonym of *C. arenicola* Steud. Mr. Clarke writes me that he has seen Steudel's type of this plant, and that it is exactly *C. reflexus* Vahl. Whether the *calcaratus* of Nees (1867–68) is the same as the *calcaratus* of Watson (1890) or a different plant, I am unable to say, but it does not affect the name, Steudel's *pseudovegetus* being much older.

DULICHIUM ARUNDINACEUM (L.) is the older name for *D. spathaceum* (L.) Pers. the synonymy being as follows:

Cyperus arundinacea L. Sp. Pl. 44 (1753).

Schœnus spathaceus L. Sp. Pl. Ed. 2, 63 (1762).

Cyperus spathaceus L. Syst. Ed. 12, **2**: 735 (1767).

The genus STENOPHYLLUS Raf. Neog. 4 (1825).

I have previously remarked on this generic name*, which is based on *Scirpus stenophyllus* Ell., noting that Mr. C. B. Clarke had proposed taking up Kunth's *Bulbostylis* (Enum. 2: 205 (1837) as a valid genus and that Rafinesque's name had twelve years priority. I am now prepared to maintain the view that the plants of which *Scirpus stenophyllus* is the type are generically distinct from both *Scirpus* and *Fimbristylis*, differing in the characters pointed out by Kunth in 1837, i. e. in *Stenophyllus* the bulbous base of the style persists on the summit of the achenium, and that the leaves are usually filiform and their sheaths ciliate. The persistent bulbous base of the style is the crucial character.

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* Bulletin **18**: 370 (1891).

The North American species known to me are as follows:

I. Spikes capitate.

a. Scales of the spikelets long-cuspidate.

✓ 1. **Stenophyllus stenophyllus** (Ell.).

Scirpus stenophyllus Ell. Bot. S. C. and Ga. **1**: 88 (1816).
Dichroma cæspitosa Muhl. Gram. 14 (1817).
Dichromena cæspitosa Spreng. Syst. **1**: 202 (1825).
Stenophyllus cæspitosus Raf. Neog. 4 (1825).
Isolepis stenophyllus Torr. Ann. Lyc. N. Y. **3**: 353 (1836).
Seirpus barbatus var. *Americanus* Bœckl. Linnæa, **36**: 752 (1870).

North Carolina to Florida and Louisiana.

b. Scales of the spikelets obtuse.

✓ 2. **Stenophyllus Warei** (Torr.).

Isolepis Warei Torr. Ann. Lyc. N. Y. **3**: 353 (1836).

Florida (Ware, Garber, Chapman, A. H. Curtiss No. 3135).

II. Spikes umbellate (sometimes solitary in depauperate forms).

✓ 3. **Stenophyllus capillaris** (L.).

Scirpus capillaris L. Sp. Pl. 49 (1753).
Isolepis capillaris R. & S. Syst. **2**: 118 (1817).
Scirpus ciliatifolius Ell. Bot. S. C. and Ga. **1**: 82 (1816).
Isolepis ciliatifolius Torr. Ann. Lyc. N. Y. **3**; 352 (1836).

Throughout nearly the whole of North America except the extreme north.

✓ 4. **Stenophyllus capillaris coarctatus** (Ell.).

Scirpus coarctatus Ell. Bot. S. C. and Ga. **1**: 83 (1816).
Isolepis coarctata Torr. Ann. Lyc. N. Y. **3**: 352 (1836).
Fimbristylis capillaris var. *coarctata* Britton, Bull. Torr. Club, **15**: 102 (1888).

Georgia and Florida.

III. Spikes solitary, terminal; fertile flowers borne also at the base of the culms.

✓ 5. **Stenophyllus Funckii** (Steud.).

Isolepis Funckii Steud. Syn. Pl. Cyp. 91 (1855).
Scirpus heterocarpus S. Wats. Proc. Amer. Acad. **18**: 171 (1883).

Arizona (Pringle); Chihuahua (Pringle, No. 1398); Mexico (Pringle, No. 3436); Jalisco (Pringle, No. 3428); Orizaba (Botteri); Bolivia (Mandon, 1410).

POTENTILLA PARADOXA Nutt.

This plant occurs in large quantities at the station long known for it near the outlet of Braddock's Bay, just east of Manitou Beach, Lake Ontario, N. Y. It differs from the European *P. supina*, L, in its stouter habit, larger flowers, thicker and less deeply dentate leaf-segments. The species, whose centre of distribution lies somewhere west of the Mississippi, is one of a considerable number of plants of similar range which extend eastward through the region of the Great Lakes and St. Lawrence River. Among these may be mentioned *Eleocharis acuminata*, which occurs as far east as Anticosti, *Corispermum hyssopifolium*, *Polygonum Hartwrightii* and *Vaccinium ovalifolium* which Prof. Macoun reports from Quebec.

GALIUM KAMPTSCHATICUM Steller.

This is among the species collected by me on the slopes of Mt. Marcy, N. Y., at elevations from 2,000 to 4,000 feet, in the autumn of 1892. I found but a single patch containing several hundred plants along the trail from Adirondack Lodge to the summit of Marcy at about 3,500 feet altitude. This was not unexpected, for a scrap of this species has long been in our herbarium bearing the label "Indian Pass, near McIntire's, W. F. Macræ, August 13, 1839." I found the plant in very old fruit and secured only a few good specimens. In this condition its elongated pedicels distinguished it readily from any form of *G. circæzans* Michx. to which it has been referred by some authors as a variety.

The plant of Oregon and Washington, which was regarded as con-specific with this by Dr. Gray, appears to me distinct from this and also from *G. circæzans*.*

Mr. Peck has recently collected specimens of a form of *G. circæzans* with perfectly glabrous corolla near Whitehall, N. Y.,

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*GALIUM OREGANUM, n. sp. Leaves oblong, ovate-oblong or ovate, acute or acutish or the lowest obtuse, ciliate on the margins and usually also on the upper side of the nerves; corolla glabrous; fruit shorter-pedicelled than that of *G. Kamptschaticum*, and twice as large when ripe. Characters based on a specimen of Howell's Oregon collections, Suksdorf's 864 from Skamania county, Washington, and Piper's 921 from Mason county, Washington. The obovate obtuse leaves sprinkled with short hairs on the upper surface of the *G. Kamptschaticum* of the Adirondacks White Mountains and Lower Canada appear to be perfectly constant.

which is a good deal more like *G. Oreganum* than is *G. Kamptschaticum.* I propose to distinguish this as *G. circæzans glabrum.**

MEEHANIA: A PROPOSED NEW GENUS OF LABIATÆ.

(PLATE 173.)

The genus *Cedronella* Mœnch, Meth. 411 (1794) is based on a tall, perennial herb of the Canaries and Madeira, the *Dracocephalum Canariense* L. Sp. Pl. 594; *Cedronella triphylla* Mœnch, loc. cit. It was taken up by Bentham (Lab. Gen. et Sp. 501–502 (1834)) and two American species added: *C. cordata*, based on *Dracocephalum cordatum* Nutt. Gen. **2**: 35 and *C. Mexicana*, based on *Dracocephalum Mexicaum* H. B. K. Nov. Gen. et Sp. **2**: 322, *t. 160.* It has since been further augmented by Mexican and Arizona species described by Lindley, A. Gray and Greene.

Cedronella cordata is a local herb of Eastern North America, ranging through the central and southern Alleghanian region, and is one of the most beautiful of our native Labiates. It is so entirely different in habit and aspect from the typical species and from those of the Southwest, and has such a limited geographical distribution, that it has long seemed to me to represent a distinct generic type, and recent comparative study has convinced me that this position can readily be maintained.

The typical species of the Atlantic islands is an erect fruticose herb with 3-foliolate leaves, or the lower sometimes with the lateral leaflets 2-parted. The verticillate clusters are many-flowered and crowded in dense round spikes. The calyx is tubular-oblong, its teeth lance-acuminate, almost subulate-tipped and nearly equal. The corolla has a narrow tube abruptly dilated above the calyx into a short throat.

The Alleghanian plant is a low, straggling herb producing long, slender, leafy stolons, the leaves simple, cordate. The clusters are but 1–3-flowered in loose, secund spikes. The calyx is distinctly campanulate and 2-lipped, the 3 teeth of the upper lip decidedly longer than the 2 lower. The corolla expands from below the top of the calyx into a very large open throat, and is pubescent within.

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* GALIUM CIRCÆZANS GLABRUM, **n.** var. Glabrous except the ciliate-margined leaves with sparingly pubescent upper surfaces. Leaves oblong, obtuse; corolla glabrous; flowers very nearly sessile; fruit not seen. Near Whitehall, N. Y., C. H, Peck, July, 1892.

There is no close congener known, the genus which I here propose being monotypic. The Arizona-Mexican plants referred to *Cedronella* (*C. Mexicana* (H. B. K.) Benth, *C. pallida* Lindl., *C. aurantiaca* A. Gray, *C. parviflora* A. Gray, *C. coccinea* Greene) have no more characters in common with *C. cordata* than has the typical species. They form a natural group, differing from both the others in their narrow, tubular corollas, scarcely at all ampliate above and by their conspicuously exserted stamens.

Meehania is dedicated to Thomas Meehan, a life-long student of plants and a liberal patron of science, who has contributed important and valuable information on systematic and physiological botany for a long period of years.

MEEHANIA Britton.

A low, pubescent, spreading or decumbent herb with long-petioled, cordate leaves, trailing, leafy stolons and large, blue flowers in terminal, secund, bracted spikes. Calyx campanulate, 15-nerved, 2-lipped, its teeth all lanceolate, acute, the 3 upper longer and slightly narrower than the 2 lower. Corolla much exserted, puberulent without, pubescent within, the tube narrow at the base, gradually widely ampliate above, the limb 2-lipped; upper lip 2-lobed, arched, about as long as the lower, the lobes ovate, obtuse; lower lip spreading, 3-lobed, the middle lobe emarginate, broader than the lateral ones. Stamens 4, didynamous, all antheriferous, ascending under the upper lip, the upper pair somewhat longer than the lower. Anthers 2-celled, the sacs parallel. Ovary deeply 4-parted. Style equally 2-cleft at the summit. Nutlets oblong, smooth.

A monotypic genus of eastern North America.

MEEHANIA CORDATA (Nutt).

Dracocephalum cordatum Nutt. Gen. **2**: 35 (1818).

Cedronella cordata Benth. Lab. 502 (1834).

Flowering stems ascending, 3′–8′ high. Stolons very slender, leafy throughout, sometimes rooting at the nodes, 1–2 ft. long; leaves all broadly ovate or ovate-orbicular, obtuse or sub-acute at the apex, crenate all around, cordate at the base, sparingly pubescent with scattered hairs on both surfaces or almost glabrous beneath, green on both sides, 1′–2′ long, the basal sinus broad; spikes 1′–4′ long; bracts ovate or oblong, acute, membranaceous, the lowest sometimes crenulate; bractlets small, lanceolate; calyx about 5′ long, equalling or longer than the bracts, puberulent, its longer teeth about one-half the length of the tube; corolla about 1′ long, showy.

In rich moist woods and thickets, Western Pennsylvania to Tennessee, Virginia and North Carolina. May–July.

The Genus Hemicarpha in North America.

BY FREDERICK VERNON COVILLE.

The genus *Hemicarpha* was published by Nees von Esenbeck in the year 1834,* based upon the species *isolepis*. The genus is now accredited with three species, *H. isolepsis*, *H. micrantha*, and *H. occidentalis*, the last of which is restricted to the Pacific coast region of the United States, while the other two are widely distributed over the earth, centering in the tropical or subtropical portions of both hemispheres. At the request of Dr. N. L. Britton, the writer presents the following account of the North American species.

HEMICARPHA MICRANTHA (Vahl) Britton.

Scirpus micranthus Vahl, Enum. Pl. **2**: 254 (1806). Type locality given doubtfully as South America.

Scirpus subsquarrosus Muhl. Gram. 39 (1817). Type specimen found on the Susquehanna river, Pennsylvania.

Isolepis micrantha R. & S. Syst. Veg. **2**: 110 (1817). Type specimen the same as that of *Scirpus micranthus*.

Isolepis subsquarrosa Schrad. in Schultes, Mant. **2**: 64 (1824). Type specimen the same as that of *Scirpus subsquarrosus*.

Hemicarpha subsquarrosa Nees, in Martius Fl. Bras. **2**: part i. 61, *t. iv. fig. 1* (1842). Type locality the same as that of *Scirpus subsquarrosus*.

Hemicarpha Drummondii Nees, in Martius Fl. Bras. **2**: part i. 62 (1842). Type specimen collected by Drummond near St. Louis, Missouri.

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* Linnæa, **9**: 287 (1834).

Hemicarpha micrantha Britton, Bull. Torr. Club, xiv. 104 (1888).

Type specimen the same as that of *Scirpus micranthus.*

Plant annual, with fibrous roots, glabrous throughout; stems closely tufted, slender, erect, or in the smaller, more broadly tufted plants recurved-spreading, 2.5 to 20 cm. high, simple, terete, glabrous, striate, nodeless; radical leaves 1 or 2, the upper with a membranaceous, purplish or brownish sheath 4 to 20 mm. long, closed to near the apex, the blade 25 mm. or less in length, sometimes obsolete, flat and 0.5 mm. wide, or much narrower and filiform; lower leaf reduced to a bladeless sheath similar to the upper, but smaller, or entirely wanting; inflorescence a cluster of 1 to 3 (usually 2) spikes at the apex of the stem, each subtended by a leaf; lowest leaf of the inflorescence erect, appearing like a continuation of the stem, commonly 5 to 20 mm. long (rarely in slender specimens reaching 100 mm.), the short, half-clasping base with membranaceous margins, the blade similar to that of the radical leaf; second and third involucral leaves similar to the lowest, but much smaller and divergent; spikes sessile, ovate to ovate-lanceolate, commonly 2 to 3 mm. (rarely 5 mm.) in length, usually acute, bearing innumerable scales on a cylindrical axis; bractlet about 1 mm. long, brown, with a green excurrent midrib, oblong-obovate, abruptly acute; perianth consisting of a single, minute, obsolescent, hyaline scale opposite the bractlet, discernible only in the flowering spike; stamen 1, opposite the axis of the spike; pistil with a well-defined style and 2 spreading, filiform stigmas; achenium brown, rarely black, subterete, clavate to narrowly oblong-obovate, 0.6 to 0.8 mm. long, the color half obscured by the air-filled, minutely and regularly cellular-punctate outer seed-coat.

This plant has a wide distribution on our continent, occurring in both North and South America. Specimens have been examined by the writer from Massachusetts, Rhode Island, New York, Pennsylvania, Wisconsin, Michigan, Kentucky, Florida, Nebraska, Indian Territory, Texas, New Mexico, Arizona, Washington, California, Mexico, Guatemela and Brazil. As might be expected of a plant of such broad range, it shows marked variation, but in all those specimens which we have referred to the type form of the species, this variation appears to be essentially one of size and external form. The plant of the Gulf and southern Atlantic states is commonly 5 to 10 cm. high and nearly erect. Toward the northern limit of its range, both in the state of Washington, on the Pacific coast; in Wisconsin, in the interior of the country; and in New England, on the Atlantic coast, the specimens become smaller in stature, commonly not exceeding 3 cm. in height, sometimes reduced even to 1 cm., while the stems assume a recurved-spreading position. A similar modification of size and habit occasionally appears in other parts of the continent, apparently due to an environment whose essential character is a reduction of the full amount of moisture habitually required by the species.

In Kansas, Texas, New Mexico and Northern Mexico occurs abundantly a form the principal character of which is its unusual height, 15 to 20 cm. This is the plant which was called by Nees von Esenbeck *Hemicarpha drummondii.* But it does not seem desirable to retain this as a varietal name, since these specimens do not appear distinguishable from individual large specimens of the type form collected in localities far removed from this region. Another related form, however, confined so far as known to Texas and Kansas, possesses additional characters and requires varietal separation.

HEMICARPHA MICRANTHA ARISTULATA var. nov.

Plant erect, the tufts 9 to 20 cm. high; spikes 1 or 2, at maturity 2.5 to 5 mm. long, made conspicuously squarrose by the awns of the bractlets; bractlets about 1.5 mm. in length, narrowly rhombic-obovate, abruptly contracted into a stout, green, spreading awn nearly as long as the body of the scale; achenium black, marked as in the type form.

Type specimen in the United States National Herbarium, collected in the year 1888, in Texas, by Mr. G. C. Nealley.

The leading character of this plant, as indicated by its varietal name, is the spreading awns of its bractlets, which give the spikes a conspicuously squarrose appearance. Its large size and black instead of brown achenia serve also to distinguish it, since black achenia occur but rarely in the type form of the species. This variety was collected also in Kingman county, Kansas, in September, 1891, by Mr. M. A. Carlton. It seems to intergrade with the type form through specimens collected in the Southern Great Plains region.

HEMICARPHA OCCIDENTALIS A. Gray.

Hemicarpha occidentalis A. Gray, Proc. Amer. Acad. 7: 391 (1868). Type specimen collected in Yosemite Valley, California, by Mr. H. N. Bolander.

Plant 1–4 cm. high, the stems erect or spreading; radical leaf with blade 5–20 mm. long, its sheath 2–5 mm. long; lowest leaf of the inflorescence 10 mm. or less in length; spike 1, rarely 2, broadly ovate in outline, 3–4 mm. long, squarrose or even hystricine; scales about 2 mm. long, narrowly lanceolate, the narrow, hyaline margins barely brownish, tapering gradually into the long, spreading awn; achenium brown, its form and surface as in the type form of *Hemicarpha micrantha.*

This species exhibits no tendency toward intergradation with *H. micrantha*, and is readily distinguishable from that plant by its broad, bristly spikes, and narrow, long-awned scales. Specimens have been examined by the writer from the type locality, and from Falcon Valley, in the State of Washington.

Two new Grasses.

By F. Lamson-Scribner.

Panicularia laxa sp. nov.

A coarse leafy grass, 2–4 ft. high, with a diffuse ample panicle and oblong, somewhat turgid spikelets. Sheaths scabrous, the lower exceeding the internodes. Ligule about 1 line long, thin, lacerate. Leaves 8–15 in. long, 3–4 lines wide, very rough-scabrous both sides tapering to a sharp point or the lower ones abruptly sharp-pointed. Panicle 7–9 in. long, the main axis and branches strongly scabrous, lower branches in 2s or 3s the upper solitary, the longer and usually widely spreading lower ones 3–5 in. long. Spikelets oblong or broadly ovate, 3–5-flowered, about 2 lines long, much exceeding the pedicels, and from 1–1½ lines wide. Empty glumes unequal, scarious-margined, the larger second glume about ½ the length of the first floret. Flowering glumes rounded on the back, 1–1¼ lines long, broadly obovate, obtuse, with a narrow scarious margin above, 7-nerved, nerves not prominent. Palea nearly equalling the glume, the keels smooth, strongly curved above.

Closely allied to *P. Canadensis*, but the smaller spikelets are green or purple-tinged, and the more obtuse floral glume scarcely exceeds the narrower palea.

Mt. Desert, Maine. J. H. Redfield and E. L. Rand. What appears to be a form of this species with smaller and imperfectly developed spikelets comes from New Jersey, Dr. H. H. Rusby, collector. We have this same form also from Mt. Desert.

POA CHAPMANIANA Scribn. (*P. cristata* Chapm. not Walter).

A strict, erect annual grass, 3–6 inches high. Leaves ½–1 inch long, a line or less wide, erect or spreading, conduplicate, at least when dry; sheaths firm, closely surrounding the culm, striate, mostly shorter than the internodes, purplish near the base. Panicle generally narrow, occasionally some of the branches more or less spreading. Spikelets ovate, about 1½ lines long, 3–6-flowered. Empty glumes nearly equal, ovate-lanceolate, acute, the second and often the first 3-nerved, distinctly scabrous on the keels above. Flowering glume ovate, rather obtuse, 3-nerved (the nerve between the marginal nerve and keel obsolete), the nerves silky villous for nearly their entire length, and at the base there is a small tuft of cob-webby hairs, which when extended exceed the length of the glume.

Allied to *Poa annua*, but the narrower, conduplicate and shorter leaves, narrower panicle, and tuft of long cob-webby hairs at base of the flowering glumes which are apparently only 3-nerved, are characters which clearly separate it from that species.

In making a new name for this grass I assume that Elliott was correct in reducing *P. cristata* Walt. to *Poa rigida* L. (*Glyceria rigida* Smith. *Festuca rigida* Kunth).

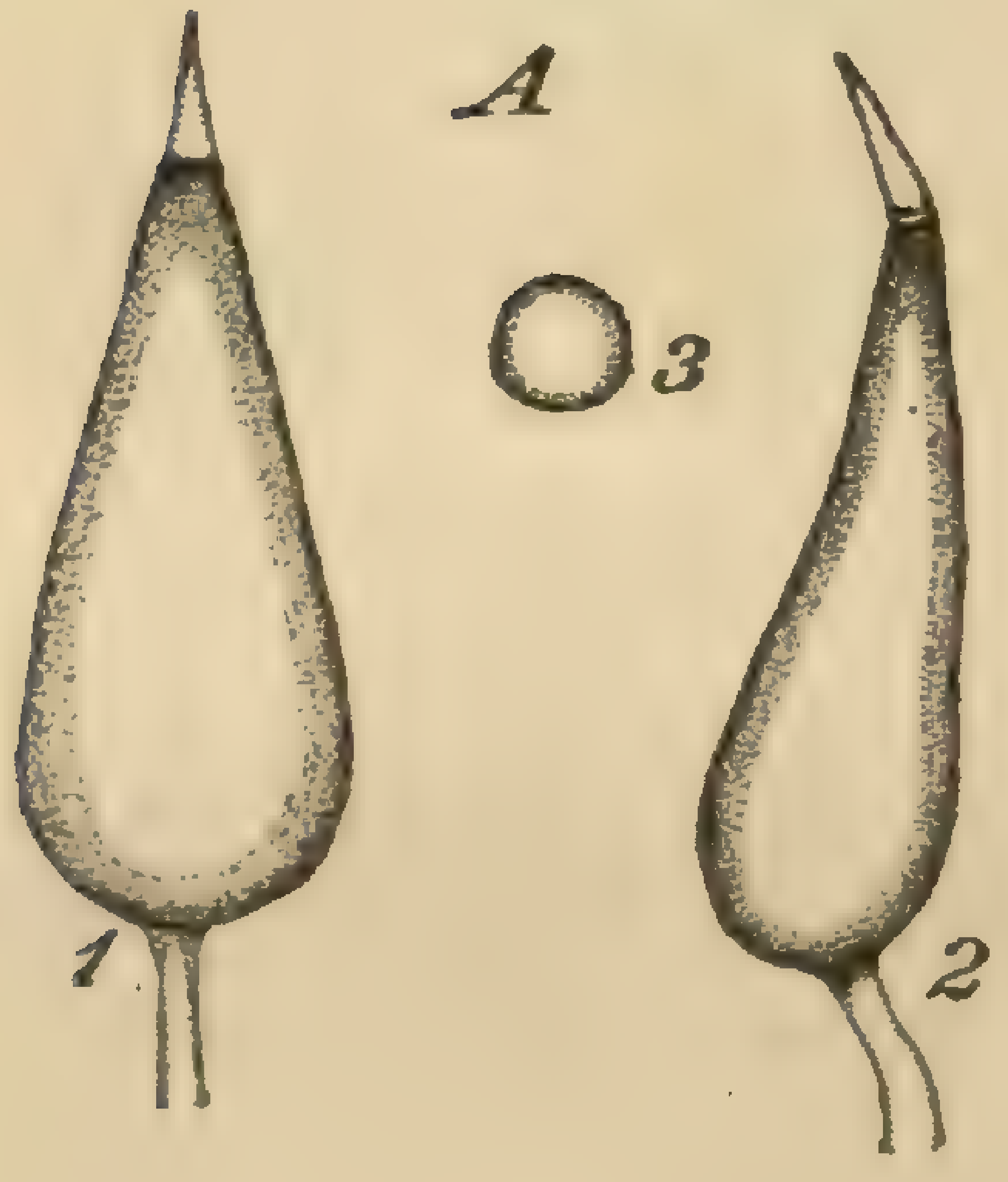
Nashville (Dr. A. Gattinger); along the Tennessee River below Knoxville (Scribner); St. Louis, Mo. (Hitchcock); Florida (Chapman).

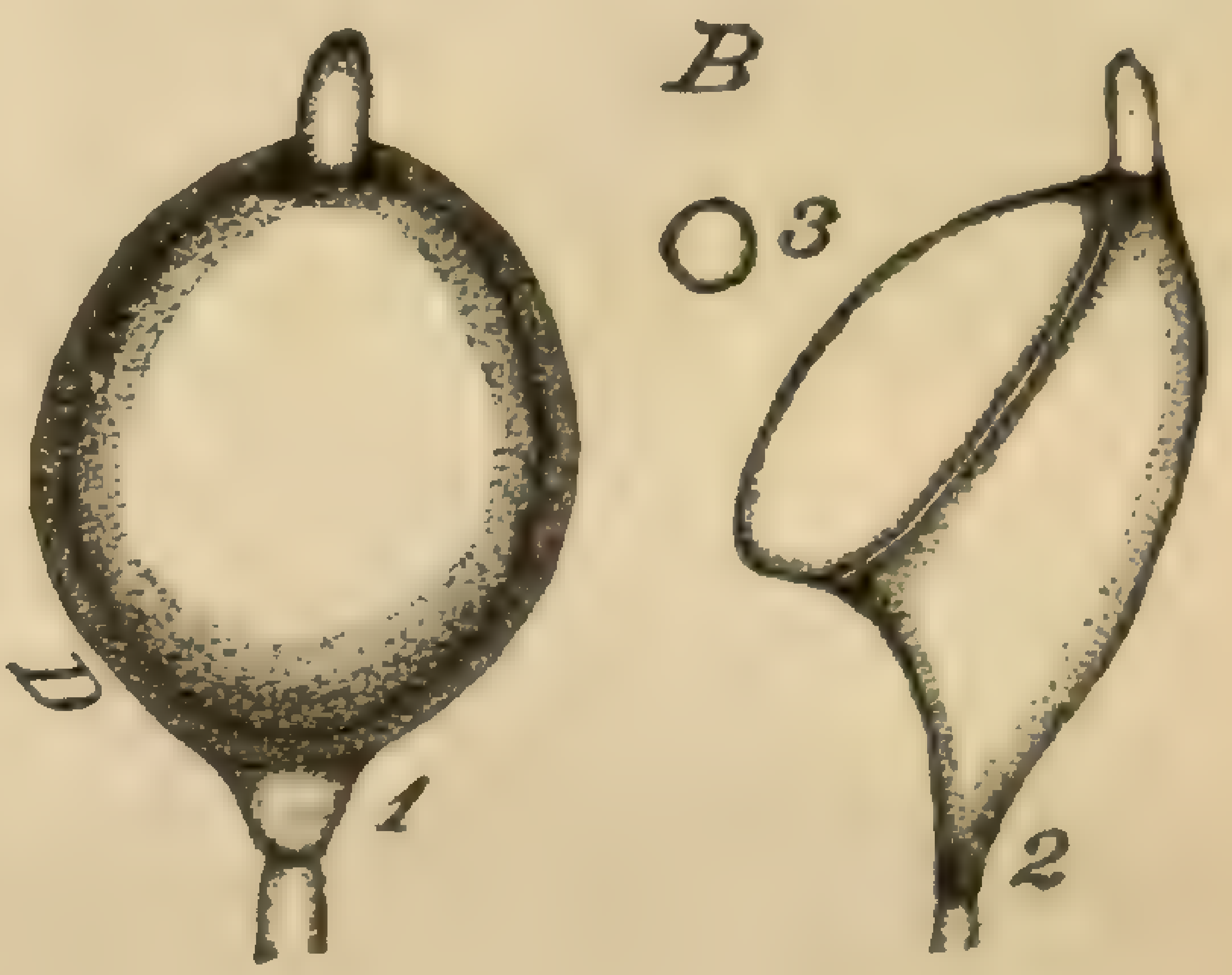
Botanical Notes.

Buxbaumia indusiata Bridel in Central New York.—On October 13, 1893, I was collecting in Enfield ravine, a large glen about eight miles from Ithaca. While examining a rotten log for liverworts, I noticed a capsule of a *Buxbaumia*. The circumstance was a surprise to me, as I at that time did not recollect having before seen a *Buxbaumia* growing on a log. The form and shape of the capsule were also peculiar. I had collected *B. aphylla* in several places, but never before had seen one that looked like this. A careful search revealed about fifteen capsules, which were growing singly about the log. They were not quite mature, but nearly enough so to show all essential parts.

Several days later, in thinking the matter over, I recollected having seen in a number of the BULLETIN an article on *Buxbaumia* *indusiata* Bridel, by Professor D. C. Eaton. The description of this species there given (Vol. 17: p. 126, 1890), fitted my specimens exactly, so that I was convinced that I had found this rare plant. Moreover, the single plant of *Buxbaumia indusiata*, in Mougeot and Nestler's "Stirp. Crypt. Vogeso-Rhenanæ," number 724, in the Herbarium of Cornell University, is, externally, almost exactly similar to my specimens. All doubt as to the identity of my plants were thus dispelled.

This is, so far as I am aware, the fourth instance of the occurrence of this species in America. Those given by Professor Eaton are: Seattle, Washington, June, 1889, by Mr. C. V. Piper, and Catskill Mountains, New York, October, 1869, by Professor C. H. Peck. Specimens were also collected by Mr. J. B. Leiberg, in Idaho, Traille River basin, 1889 (BULL. TORR. CLUB, 1891, p. 49). It will thus be seen, that of the four known American stations, two are in New York State, and two in the extreme West.





B. indusiata occurs always on decayed logs, usually on coniferous ones, although my specimens were on some other wood. In my experience, *B. aphylla* occurs always on the ground, in high woods, on black moist earth, covered with a greenish confervoid growth.

ELIAS J. DURAND.

BOTANICAL DEPARTMENT, CORNELL UNIVERSITY.

Explanation of Figures.

Figure B1 was drawn from a dried specimen; the others from fresh material.

A1, *Buxbaumia indusiata.* Capsule, dorsal aspect × 7; A2, lateral aspect × 7; A3, spore × 290.

B1, *Buxbaumia aphylla.* Capsule, dorsal aspect × 7; B2, lateral aspect of same × 7; B3, spore × 290.

The Mint Rust npon the Variegated Balm.—At a commercial greenhouse recently visited the writer was surprised to find a quantity of variegated or silver balm (*Melissa officinalis*) infested with the mint rust *Puccinia Menthæ* Pers.). This fungus is one of the most common and widespread of all the genuine rusts, having no less than thirty species of hosts scattered through the following and other genera of the Labiatæ, namely: *Mentha*, *Thymus*, *Calamintha*, *Nepeta*, *Cunila*, *Monarda*, *Hedeoma*, the leading American host genera being *Mentha*, *Pycnanthemum* and *Monarda.*

As Dr. Burrill notes* the American form of the species is markedly different from the European in the echinulate teleutospores. It is this forma *Americana*, as Saccardo styles it, that infests the *Melissa*.

The host is an Old World species, and it is interesting to note that it has adopted the American style, so to speak, for its form of rust. The same is true of the *Mentha piperita* (peppermint), the only other member of the mint family that the writer has seen badly attacked by the rust while growing under glass.

There is a large field for this rust within the greenhouse should it spread to one or more of a long list of the members of the mint family. The *Coleus* alone, in all its great number of popular varieties, might, in becoming a victim to *Puccinia Menthæ*, cause as much alarm among commercial and other gardeners as the rust of the hollyhock or of the carnation.

There seems to be no choice whatever on the part of the parasite between the etiolated and green parts of the balm leaves as far as one may judge from the even distribution of the rust sori. This is as might be expected, for the *Puccinia* is a deep, wide feeder throughout the tissues of the host, and fruiting is the last stage of its growth.

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* Parasitic Fungi of Illinois p. 190.

Authors, Saccardo, Winter, Cohn, Burrill and others make no mention of *Melissa* as a host for *Puccinia Menthæ* Pers.

BYRON D. HALSTED.

Ranunculus micranthus Nutt.—Having had good opportunities of observing this plant in the field, and of comparing it in life with *R. abortivus* L., I am fully satisfied that it should be restored to the full specific rank given it by its describer in 1838. It is normally a lower plant than *abortivus*, sometimes a foot and a half high, but usually under a foot, and often flowering from a simple stem barely three inches high. It is also more slender than *abortivus*, the base of the stem and petioles especially being weaker and more lax. The leaves, too, are not at all fleshy as in that species, and of a deeper, duller green, giving the plant a noticeably different appearance, which is further heightened by its pubescence, this feature being especially evident in young plants. The leaves throughout are smaller than in *abortivus*, the root leaves on longer petioles and never at all heart-shaped, but narrowed or rounded at the base, crenate-dentate to dentate-serrate, often entire below the middle. Stem leaves with much narrower divisions and sharper dentition than in *abortivus*. In the latter I find the much larger root-leaves always deeply heart-shaped or kidney-form, and sub-crenate or crenate around the entire outer margin. The flowers of the two plants differ noticeably on comparison. The petals of *micranthus* are much longer and narrower than in *abortivus*—linear, and at least three times longer than broad, instead of ovate or sub-ovate, and nearly as broad as long. The sepals also are narrower and abruptly contracted into a stalk-like base, instead of rounded or gradually narrowed at their attachment. The distinctness of the plants is also borne out by the fruit. In *micranthus* the fruit-heads are often larger than in *abortivus*, oblong instead of sub-globular, the achenes slightly smaller, not so closely sessile or so crowded, and in shape less prominently arched over towards the beak, which is rather more produced than in *abortivus*. When fresh they have a dull surface showing finely cellular under the lens and contrasting strongly with the bright green and shining achenes of *abortivus*. The receptacle of the fruit is in *micranthus* much longer than in *abortivus*—linear instead of oblong, and presents a noteworthy differential character in being glabrous (sometimes a few hairs are found at the extreme tip) instead of hairy as in the contrasted plant, this feature reversing the character of the stem and leaves of the two species. *R. abortivus* thrives under widely different conditions, and is to be found equally at home on rocks, wooded banks, or in low grounds. *R. micranthus* is evidently a species adapted to a more narrow environment. I have found it growing only in light rich soil—often in black earth—which has lodged in depressions or crevices in rocks usually in exposed situations in high open woods. Such places it often occupies in close communities. I have occasionally found *abortivus* growing with it, the two plants showing not the slightest tendency to intergrade. Furthermore, *R. micranthus* comes into flower somewhat later than *abortivus*.

E. P. BICKNELL.

RIVERDALE ON HUDSON, NEW YORK.

Proceedings of the Club.

TUESDAY EVENING, DECEMBER 12TH, 1893.

The President in the chair and twenty persons present.

The following report of the Instruction Committee for 1893 was presented and accepted:

Since the last report of this committee the courses of instruction then announced, commencing April 27 and ending June 29, have been given as follows:

Dr. Thomas Morong, who conducted the general course, states that his class consisted of 28 members, the greater part of them from this city. The interest of the members was excellent, as was the attendance until the latter part. Of the course more than three-fourths of the members were always present until about the middle of June, when the attendance fell off more than one-half, owing, according to information, to the removal of many of the members into the country.

Two excursions were made each week, and these were even more highly enjoyed and appreciated than the lectures. As a means of imparting direct and familiar instruction, and of meeting the practical difficulties of the students, such excursions are indispensable.

Only two candidates for diplomas presented themselves for examination at the close of the course, although several others have since expressed their regrets that they did not do so. By each of the candidates about 80 per cent. of the questions were very satisfactorily answered, and diplomas were issued to them.

Mr. Henry Kraemer, who conducted the course in Microscopical Botany, reports that his class contained seven members and that ten lessons were given. An oral examination was conducted and four members were awarded diplomas.

Miss Effie A. Southworth read a paper entitled "A Review of the Nitrogen Question." Following an enumeration of the forms in which nitrogen was offered to the plant was a review of the early work by Boussingault and others, leading to the conclusion that free nitrogen was not available as plant food. Offered to the roots, plants prefer nitrates to ammonia salts. An examination of leguminous plants showed that they possessed peculiar qualities of absorbing nitrogen. This led to an examination of the tubercles found on their roots. After a review of the different theories concerning the nature and function of these tubercles it was stated as the present accepted notion that they are caused by infection by a fungus, and have some connection with the nitrogen producing qualities of the plants, that is, by symbiosis with the fungus the macrosymbiant can make use of more nitrogen than it otherwise could. This work on the tubercle was followed by a new investigation of the sources of nitrogen for plants in general. Dr. B. Frank has especially worked upon this subject, and come to the conclusion that all plants absorb the free nitrogen of the air, and that the early stage of growth before the full development of the foliage, in the time when nitrates are especially required, free nitrogen assimilation becoming established when full foliage appears.

The paper was discussed by Dr. Curtiss and Prof. Rusby, who pointed out that even if it were proven that all plants absorbed free nitrogen, it could not be that they would at any period become independent of nitrates, as the fertilization of crops by nitrates in all stages of growth was productive of good results.

Mr. T. H. Kearney, Jr., read a "Report on the Botanical Exploration of Southeastern Kentucky in 1893," illustrated by specimens. The collections included 323 species made in six weeks of August and September, six being new to Gray's Manual region, with one variety and probably one species new to science.

Reviews and Notes on Literature.

Introduction to Botany. V. M. Spalding, Professor of Botany in the University of Michigan. (Small 8vo. pp. 246, Boston and New York, D. C. Heath & Co., 1893).

Teachers of botany, both in colleges and preparatory schools, have for a long time felt the need of some improvement in the methods of preparatory work. Botany, as it is at present taught in the great majority of preparatory schools, is too much of a cut-and-dried subject; and the student, when he has completed the regulation twenty weeks' course, feels that he has completed the subject as well, and enters college with the idea that the study of botany means learning the shapes of leaves and pressing plants. He has hardly had a glimpse at the structure, the physiology, or the relationship of the plant whose Latin name he has tried in vain to memorize; and as for plants that do not bear flowers he may not know of their existence, below the ferns.

The University of Michigan has recently made botany one of the requisites of preparation for the courses in the Literary Department. But the inevitable trouble of poor preparation arose, and to meet this need Prof. Spalding has issued a text-book, which covers the ground that, in his opinion, should be gone over in the high school. It is the product of a long experience in teaching, both in high school and college, and its author has for some time had the advantage of putting his methods to a practical test.

The book is primarily designed to teach the student to study nature for himself, and to do this the author makes use of the laboratory method. The chapters on organography include most of the subjects treated of in Gray's Lessons, and something of the structure of the different organs as well, but they are guides to laboratory study rather than descriptions and classifications of organs.

The systematic part is even more of a departure from the ordinary methods than the morphological. The student is introduced to some of the important families by a careful study of one or more species; he is then expected to compare this species with others of different genera, and so gain a conception of the family.

Plant analysis, in the sense of tracing the name by means of an artificial key, is not included, but the student who has gone through with the work laid out will be able to use Gray's Manual with perfect ease, and in most cases will know the order of a plant even without its use. There are several chapters which give a slight insight into the cryptogamic orders. In order to follow them all the compound microscope will be needed.

The book is not intended to supplant but to supplement others. On nearly every page the student is referred to other text-books, and it will be impossible for him to carry out the author's design without a knowledge of Gray's Lessons and some acquaintance with Darwin and Müller. If it can be adopted in our high schools it will give new life to the beginning of botanical study. The principal drawbacks to its use will be in finding high school teachers who are capable of carrying it out, and schools that are able and willing to incur the expense of fitting up a laboratory. E. A. S.

Botany of the Death Valley Expedition.—A Report on the Botany of the Expedition sent out in 1891 by the United States Department of Agriculture to make a Biological Survey of the region of Death Valley, California. Frederick Vernon Coville. (Contrib. U. S. Nat. Herb. Vol. 4, 318 pages, 21 plates and a map. Washington, 1893).

"In 1886 and subsequent years appropriation was made by Congress for a study of the geographic distribution of animals, to be conducted by the Division of Ornithology and Mammalogy, United States Department of Agriculture. In the year 1890 the scope of the work was enlarged by act of Congress so as to include the distribution of plants as well as animals, and in accordance with this provision the writer was temporarily detailed from the Division of Botany as botanist of the Death Valley Expedition, the first of the biological surveys under the new act."

The foregoing extract from Mr. Coville's preface indicates the origin of the fine piece of work now so successfully accomplished. The subject-matter is presented under the following heads: (1.) Itinerary. (2.) Principles of plant distribution. (3.) Distribution of plants in Southeastern California. (4.) Characteristics and adaptations of the desert flora. (5.) Catalogue of species. (6.) Catalogue of specimens. (7.) Bibliography. The principles of nomenclature recommended by the Botonical Club of the American Association for the Advancement of Science have been followed. The whole number of species and varieties recorded is 1,261, 42 of which are new to Science. Some of these have previously been described by Mr. Coville in a paper published in the Proceedings of the Biological Society of Washington;* those here first described are *Aquilegia pubescens*, *Ceanothus pinetorum*, *Lotus Argensis*, *Astragalus eremicus* Sheldon, *Astragalus Inyoensis* Sheldon, *Astragalus Panamintensis* Sheldon, *Astragalus Virgineus* Sheldon, *Gayophytum eriospermum*, *Œnothera xylocarpa*, *Cymopterus Panamintensis* Coulter and Rose, *Phlox austromontana*, *Navarretta setiloba*, *Nemophila spathulata*, *Phacelia hispida brachyantha*, *Cryptanthe recurvata*, *Mohavea breviflora*, *Pentstemon fruticiformis*, *Boerhavia annulata*, *Atriplex Tularensis*, *Eriogonum brachyanthum*, *Eriogonum nivale*, *Phyllogonum luteolum*, *Juncus orthophyllus*, *Ephedra viridis*, *Uromyces bicolor* Ellis and *Phleospora Biglovicæ* Ellis.

Two new genera are proposed: *Orechænactis*, based on *Chænactis thysanocarpha* A. Gray, in the Compositæ and *Phyllogonum* in the Polygonaceæ, based on a newly-discovered species.

The list of plants collected is enriched by numerous valuable notes on habit, habitat, distribution, additional characterizations, modifications of former descriptions and nomenclature. The plates illustrate many of the new species. They are lithographed and well executed.

Altogether the book is a most important contribution to American botany, and we feel sure that in extending to Mr. Coville our congratulations on its completion that we are but voicing the sentiments of all American botanists. N. L. B.

Contributions to the Life Histories of Plants, No. 9. Thomas Meehan (Proc. Acad. Nat. Sci. Phila. 1893, 289–309).

Mr. Meehan's ninth collection of notes under this caption includes memoranda on a Monœcious Case of *Populus tremuloides;* Extra-axillary Branching in *Mertensia maritima;* Dichotomous Branching in *Spergularia media;* Missing Verticil in *Glaux maritima;* The Relation between Rythmic Growth and Variety in

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* Vol. 1: 65–80 (1892).

Citrus Fruits; Morphology of the Stipule in *Comarum palustre*; Fertilization of *Malva rotundifolia;* the Peduncle of *Brunella vulgaris;* Branching of *Euphorbia hypericifolia* and *E. maculata;* Dimorphic Forms of *Lythrum Salicaria;* Structure of Florets in *Bidens bipinnata;* Rythmic Growth in Flowers of *Heliopsis lævis;* Floccose Leaves of *Antennaria plantaginifolia;* Endurance of *Partulaca oleracea;* Early Fertilization of *Scutellaria galericulata* and Fertilization of *Trifolium pratense.*

Enumeratio Myrtacearum Brasiliensium. Hjalmar Kiærskow. 8 vo. pp. 199, tab. 24. Christiania, 1893).

This is an enumeration, with descriptions of many new species, of the Myrtaceæ collected in Brazil by Glaziou, Lund, Mendonca, Raben, Reinhardt, Schenck, Warming and others, and forms the thirty-ninth paper in Professor Warming's contributions to the Botany of Central Brazil. Four hundred and nineteen species are recognized. The author's treatment of the order differs from that of Berg, in Martius' "Flora Brasiliensis," chiefly in the recognition of fewer genera, nearly all of the species proposed by Berg being maintained. The illustrations are made up partly from drawings and partly from reproductions of photographs of herbarium specimens. N. L. B.

Index to Recent Literature relating to American Botany.

Bailey, L. H. Another side of the Nomenclature Question. Erythea 2: 10–12. 2 Ja. 1894.

Relations of nomenclature to horticulture.

Blochman, Ida M. Californian Herb-lore.—III. Erythea 2: 9, 10. 2 Ja. 1894.

Saponaceous plants of Southern California.

Davidson, Anstruther. Californian Field Notes.—I. Erythea 2: 1–2. 2 Ja. 1894.

Notes on *Calochortus.* Reduces *C. Lyoni* to *C. Catalinæ.*

Greene, Edw. L. Correct Nomenclature, etc. Erythea 2: 12, 13. 2 Ja. 1894.

Greene, Edw. L. Dr. Britton and Mr. Britten and *Jacksonia.* Erythea 2: 6–9. 2 Ja. 1894.

Maintains *Jacksonia* Raf. in place of *Polanisia* Raf.

Hill, E. J. *Viola palmata* Linn.—Meehan's Month. **4**: 4. Ja. 1894.

Notes on the variations of *V. palmata*, *V. sagittata* and *V. pedatifida* in the vicinity of Chicago, Ill.

Jepson, Willis L. Teratological Notes. Erythea **2**: 14, 15. 2 Ja. 1894.

(Meehan, Thomas.) *Sarracenia variolaris*. Meehan's Month. **4**: 1–2. Ja. 1894.

Colored illustration of *S. variolaris*.

Michener, C. Publication of Varieties. Erythea **2**: 13, 14. 2 Ja. 1894.

Michener, C. R. & P. Erythea **2**: 3–5. 2 Ja. 1894.

Brief account of labors of Ruiz and Pavon and a few species described by them.

Pringle, C. G. The Mexican Ash. Gard. & For. **7**: 14. 10 Ja. 1894.

Note on *Fraxinus Berlandieriana*.

Sargent, C. S., Editor. The Cocoanut tree. Gard. & For. **7**: 13–14. 10 Ja. 1894.

With illustration of a group of trees at Key West, Fla.

Sargent, C. S., Editor. The Red Mulberry tree. Gard. & For. **7**: 23. 17 Ja. 1894.

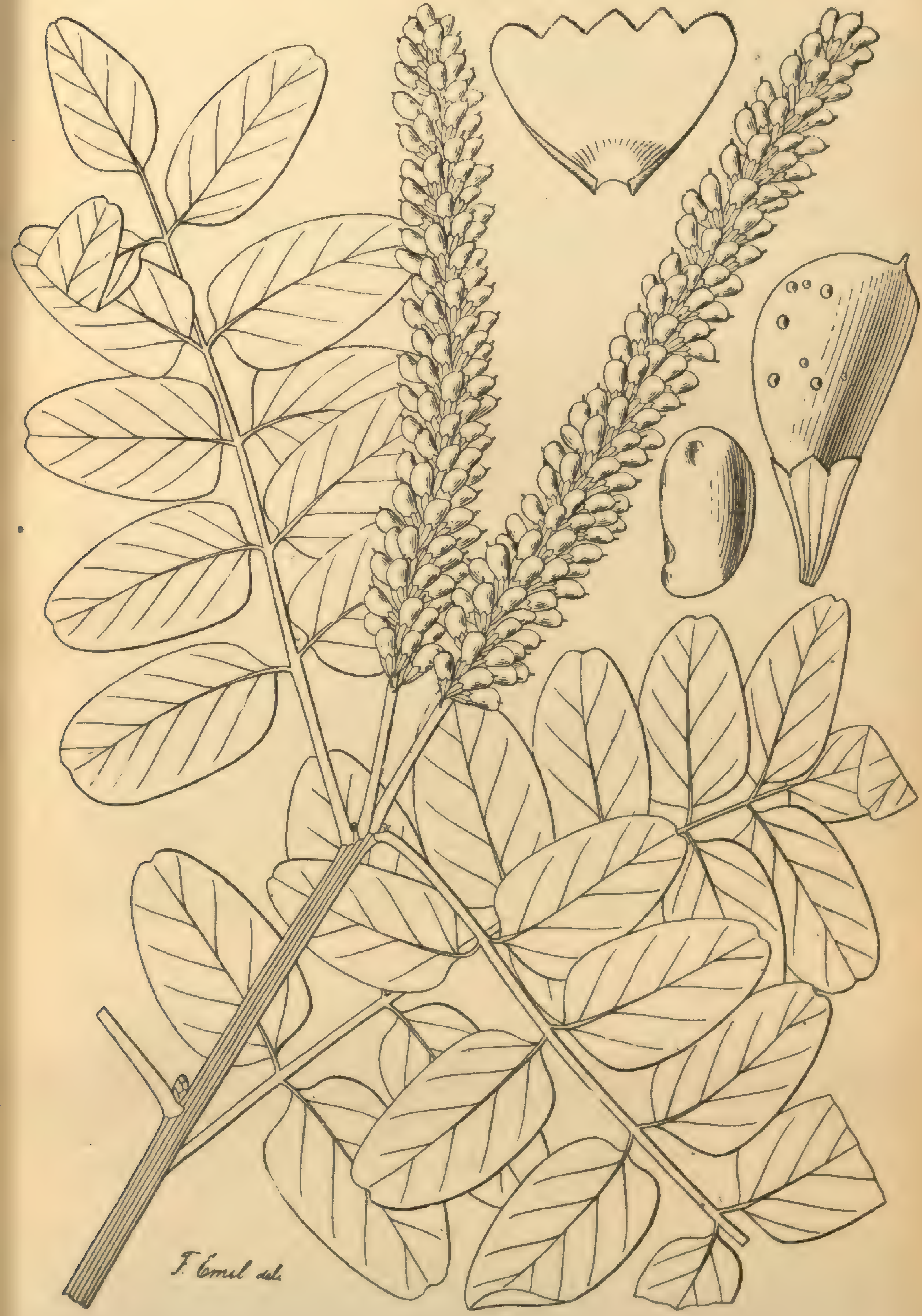
With illustration of *Moras alba* in *Alabama*.

Sargent, C. S., Editor. Josiah Gregg. Gard. & For. **7**: 12. 10 Ja. 1894.

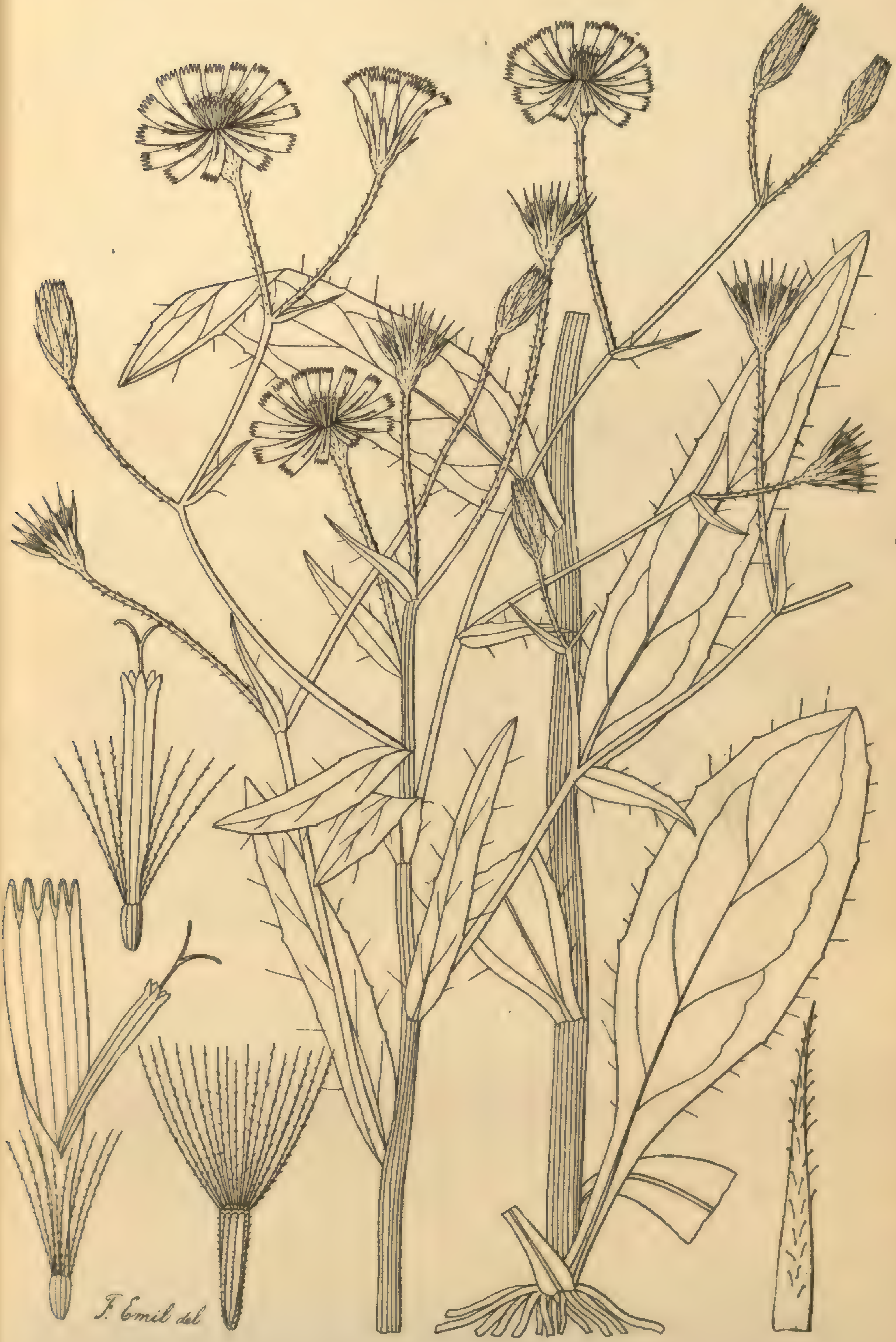
Recollections of the life and work of Josiah Gregg from a letter written by Dr. Bigelow.

Trelease, W. Sugar Maples, and Maples in Winter. Fifth Ann. Rep. Missouri Bot. Gard. Reprint, 1–19, *pl. 1–16*. 1 Ja. 1894.

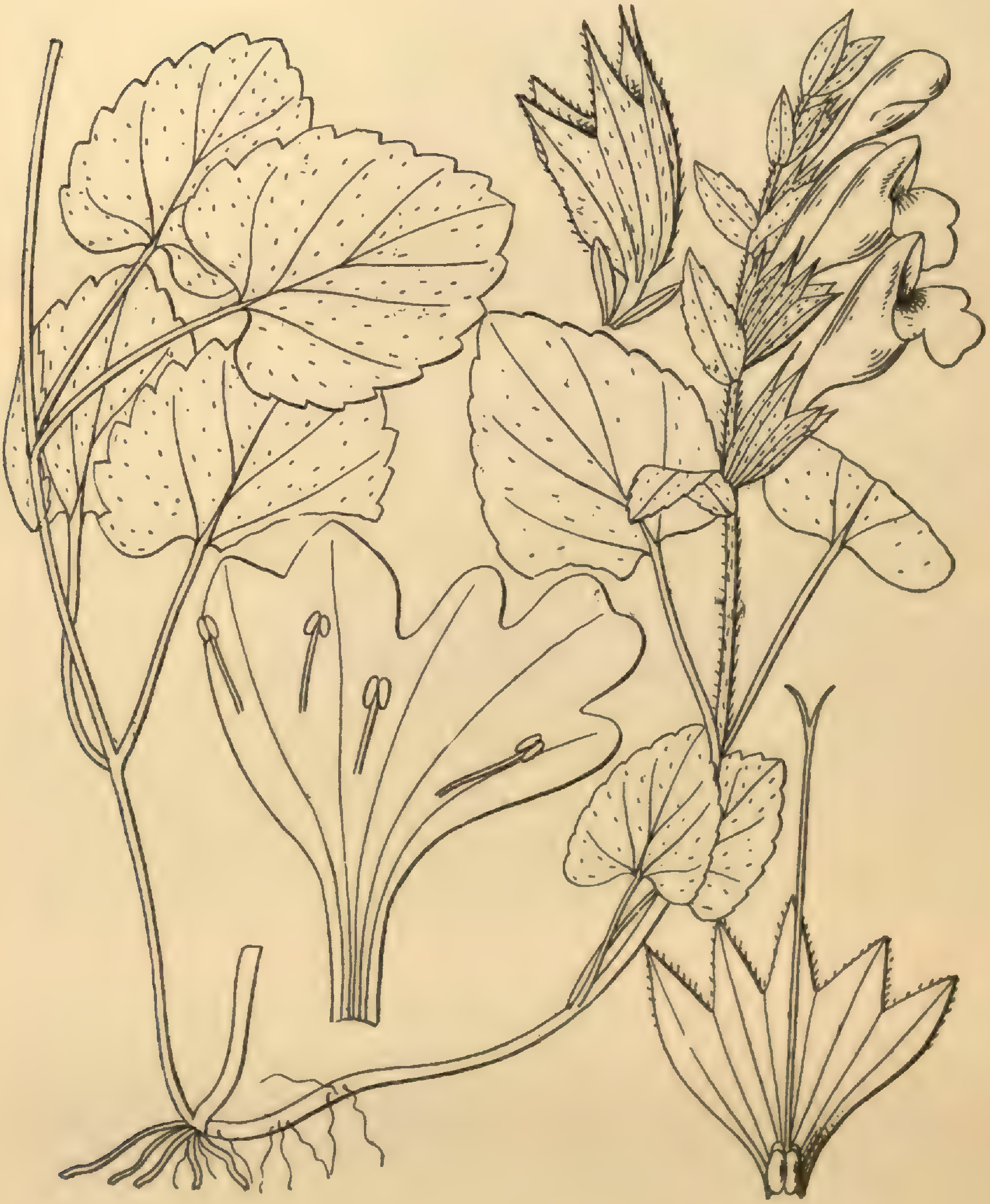
Trelease, W. The North American Species of *Gayophytum* and *Boisduvallia*. Fifth Ann. Rep. Missouri Bot. Gard. Reprint, 1–16, *pl. 1–26*. 5 Ja. 1894.



AMORPHA VIRGATA SMALL.



HIERACIUM SCRIBNERI SMALL.



MEEHANIA CORDATA (NUTT.) BRITTON.

Contributions from the Herbarium of Columbia College.

No. 1. A Preliminary List of North American species of *Cyperus*, with Description of New Forms. By N. L. Britton (1886), ... **25 cents.**

No. 2. *Cerastium arvense*, L., and its North American Varieties. By Arthur Hollick and N. L. Britton (1887). (Out of print.)

No. 3. Plant Notes from Temiscouata County, Canada. By J. I. Northrop (1887). (Out of print.)

No. 4. A List of Plants Collected by Miss Mary B. Croft at San Diego, Texas. By N. L. Britton and H. H. Rusby (1887), ... **25 cents.**

No. 5. New or Noteworthy North American Phanerogams. By N. L. Britton (1888), ... **25 cents.**

No. 6. An Enumeration of the Plants Collected by Dr. H. H. Rusby in South America, 1886–1887. By N. L. Britton. (Twenty-three parts published; not yet completed.)

No. 7. The Genus *Hicoria* of Rafinesque. By N. L. Britton (1888), . **25 cents.**

No. 8. A Recent Discovery of Hybrid Oaks on Staten Island. By Arthur Hollick. (1888), ... **25 cents.**

No. 9. A List of Plants Collected by Dr. E. A. Mearns at Fort Verde and in the Mogollon and San Francisco Mountains, Arizona, 1884–1888. By N. L. Britton.

The General Floral Characters of the San Francisco and Mogollon Mountains and the Adjacent Region. By H. H. Rusby (1888), . . 25 cents.

No. 10. Contributions to American Bryology—An Enumeration of the Mosses Collected by Mr. John B. Leiberg in Kootenai County, Idaho. By Elizabeth G. Britton. (Out of print.)

No. 11. Preliminary Notes on the North American Species of the Genus *Tissa*, Adans. By N. L. Britton (1889), ... **25 cents.**

No. 12. The Genus *Eleocharis* in North America. By N. L. Britton (1889), **25 cents.**

No. 13. New or Noteworthy North American Phanerogams, II. By N. L. Britton 1889), ... **25 cents.**

No. 14. A List of State and Local Floras of the United States and British America. By N. L. Britton (1890), ... **$1.**

No. 15. A Descriptive List of Species of the Genus *Heuchera*. By Wm. E. Wheelock (1890), ... **25 cents.**

No. 16. New or Noteworthy North American Phanerogams, III. By N. L. Britton (1890), ... **25 cents.**

No. 17. The Flora of the Desert of Atacama. By Thos. Morong (1891), **25 cents.**

No. 18. Contributions to American Bryology, II. A supplementary Enumeration of Mosses collected by Mr. John B. Leiberg in Kootenai County, Idaho. By Elizabeth G. Britton (1891), ... **25 cents.**

No. 19.	Notes on North American Halorageæ. By Thos. Morong (1891),	25 cents
No. 20.	New or Noteworthy North American Phanerogams, IV. By N. L. Britton. (1891),	25 cents.
No. 21.	Notes on the North American Species of Eriocauleæ. By Thos. Morong (1891),	25 cents.
No. 22.	New or Noteworthy North American Phanerogams, V. By N. L. Britton (1891),	25 cents.
No. 23.	The American Species of the Genus *Anemone* and the Genera which have been referred to it. By N. L. Britton (1891),	25 cents.
No. 24.	Review of the North American Species of the Genus *Xyris*. By Heinrich Ries (1892),	25 cents.
No. 25.	A Preliminary List of the Species of the Genus *Meibomia* occurring in the United States and British America. By Anna M. Vail (1892),	25 cents.
No. 26.	A List of Species of the Genera *Scirpus* and *Rynchospora* occurring in North America. By N. L. Britton (1892),	25 cents.
No. 27.	Note on a Collection of Tertiary Fossil Plants from Potosi, Bolivia. By N. L. Britton (1892),	25 cents.
No. 28.	The Anatomy of the Stem of *Wistaria Sinensis*. By Carlton C. Curtiss (1892),	25 cents.
No. 29.	New or Noteworthy North American Phanerogams, VI. By N. L. Britton (1892),	25 cents.
No. 30.	*Ranunculus repens* and its Eastern North American Allies. By N. L. Britton (1892),	25 cents.
No. 31.	A Preliminary List of American Species of *Polygonum*. By John K. Small. (1892),	25 cents.
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VOL. 21. FEBRUARY, 1894. No. 2.

BULLETIN

OF THE

TORREY BOTANICAL CLUB.

A MONTHLY JOURNAL OF BOTANY.

EDITED BY

NATHANIEL LORD BRITTON,

AND OTHER MEMBERS OF THE CLUB.

CONTENTS:

PAGE.
Additions to the Palæobotany of the Cretaceous Formation on Long Island (Plates 174–180): *Arthur Hollick* 49
Contributions to American Bryology—Notes on the North American Species of *Weissia* (*Ulota*): *Elizabeth G. Britton* 65
Club-Root in Common Weeds (Illustrated): *Byron D. Halsted* 76
Potentilla recta L.: *E. J. Hill* 79
BOTANICAL NOTES.—Note on the Herbarium of Stephen Elliott: *N. L. Britton;* Heliotropism of *Cassia Marylandica: Geo. F. Atkinson; Leucampyx Newberryi* A. Gray: *T. H. Kearney, Jr.;* Dr. Parry's Herbarium 80
REVIEWS AND NOTES ON LITERATURE.—The North American *Delphiniums;* Researches on the Diatoms; The Bryological Flora of Japan 82
PROCEEDINGS OF THE CLUB 85
INDEX TO RECENT LITERATURE RELATING TO AMERICAN BOTANY 87

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BULLETIN
OF THE
TORREY BOTANICAL CLUB.

Vol. 21. Lancaster, Pa., February 20, 1894. No. 2.

Additions to the Palæobotany of the Cretaceous Formation on Long Island.

[PLATES 174–180.]

BY ARTHUR HOLLICK.

In previous contributions* may be found descriptions and figures of ten species of cretaceous leaves from the north shore of Long Island. Since these contributions were prepared, considerable new material has been added from several sources, besides which, all the material previously collected but not described has been subjected to careful examination. The results obtained it is the object of this paper to present.

For part of the new material I am indebted to the courtesy of the Long Island Historical Society, in whose collection are several valuable specimens, which I was allowed every possible facility to study. Another series of specimens was collected by Mr. Gilbert Van Ingen, curator in the geological department of Columbia College, and the remainder was personally collected in connection with the summer school of geology of Columbia College. All the specimens, with the exception of those belonging to the Long Island Historical Society, are now in the geological museum of Columbia College.

---

* i. "Preliminary Contribution to Our Knowledge of the Cretaceous Formation on Long Island and Eastward." Trans. N. Y. Acad. Sci. **12**: 222–237, *pl. 5–7* (1893).

ii. "A New Fossil Palm from the Cretaceous Formation at Glen Cove, Long Island." Bull. Torr. Bot. Club, **20**: 168, 169, *pl. 149* (1893).

iii. "Some Further Notes upon *Serenopsis Kempii.*" Bull. Torr. Bot. Club, **20**: 334, 335, *pl. 166* (1893).

It will not be necessary, in this contribution, to discuss any of the geological problems connected with these plant remains; this has already been done in part* and may be found further considered in a paper read before the New York Academy of Sciences, January 22, 1893, and now in course of publication in the Transactions.

It is sufficient here to say that the specimens personally collected were found on Eaton's Neck, Lloyd's Neck, Oak Neck, and in the vicinity of Glen Cove. Mr. Gilbert Van Ingen's collection was made at Sea Cliff, and the specimens belonging to the Long Island Historical Society were found in Brooklyn. The following fifty-one descriptions include forty-six additions to the previously recognized cretaceous flora of Long Island, nine of which are new species.

In many instances I have been able to identify the Long Island species with unpublished descriptions and figures by Dr. J. S. Newberry, representing the Amboy clay flora of New Jersey. Where such has been the case I have retained Dr. Newberry's manuscript names.

Descriptions of Species.

SALIX PROTEÆFOLIA FLEXUOSA Lesq. (Pl. 174. f. 5.)

Salix proteæfolia var. *flexuosa* Lesq. Fl. Dak. Gr. 50, *pl. 64, f. 4, 5.*

Amongst the numerous specimens of *Salix* from the Amboy clays are several identified by Newberry as *S. proteæfolia* Lesq. They vary considerably in size and it is probable that some of them may be referable to this variety.

Locality: Sea Cliff.

SALIX PURPUROIDES n. sp. (Pl. 174, f. 9.)

Leaf small (1$\frac{1}{8}$ in. long, $\frac{3}{16}$–$\frac{1}{4}$ in. wide); narrowly lanceolate; tapering gradually to the acute base and somewhat abruptly to the bluntish apex; entire; midrib rather prominent; secondaries thin, numerous, irregularly disposed, leaving the midrib at an acute angle, slightly curved and extending upward along the margin.

---

* *loc. cit.* 222–234.

This little leaf resembles quite closely those of the living *S. purpurea* L., as I have indicated in the specific name.

Locality: Sea Cliff.

JUGLANS CRASSIPES Heer. (Pl. 175, f. 3.)

Juglans crassipes Heer, Fl. Moletein, 23, *pl. 6, f. 3.*

Also identified from the cretaceous of Kansas by Lesquereux* and by Heer from Greenland.† So far as I am aware it has not been previously reported from the eastern United States.

Locality: Brooklyn, *fide* specimen in the cabinet of the Long Island Historical Society, "De Kalb Avenue, near Reid Street. G. Hurst, No. 233."

JUGLANS ARCTICA Heer. (?) (Pl. 178, f. 2.)

Juglans arctica Heer, Fl. Foss. Arct. **6**: 71, *pl. 40, f. 2; 41, f. 4c; 42, f. 1–3; 43, f. 3.*

It is always hazardous to identify a species from such a fragment as ours, and I have only placed it provisionally under the above name. Some of Heer's figures represent specimens scarcely less fragmentary, however, and the comparison does not seem unwarranted. It has also been collected at Woodbridge, N. J., and is reported from the cretaceous of Kansas by Lesquereux.‡

Locality: Glen Cove.

FICUS PROTOGÆA Heer (?) (Pl. 175, f. 4).

Ficus protogæa Heer, Fl. Foss. Arct. **3**: 108, *pl. 29, f. 2b; 30, f. 1–8.*

Although both base and apex are missing from our specimen, its provisional reference to the above species seems reasonable, especially as fruit, referred to the same species, has been found in the cretaceous of Kansas.§ It has not been elsewhere reported, however, from the United States.

Locality: Glen Cove.

---

* Fl. Dak. Gr. 69, *pl. 49, f. 1–3.*

† Fl. Foss. Arct. **7**: **27**, *pl. 61, f. 4; 65, f. 9.*

‡ Fl. Dak. Gr. 68, *pl. 19, f. 3; 39, f. 5.*

§ Fl. Dak. Gr. 85, *pl. 10, f. 7, 8.*

FICUS WILLISIANA n. sp. (Pl. 176, f. 2, 5).

Leaf large, apparently about 7 in. long by 4 in. wide at broadest part, tapering to the acute apex; margin entire; midrib and secondaries rather slender for the size of the leaf, the latter conspicuously curved upward and comptodrome.

A full description of this leaf is impossible from the material now in our possession, but it is evidently such a distinctive species that the portions figured will serve to identify it in case more perfect specimens should be found in the future.

Named for Mr. Bailey Willis, of the U. S. Geological Survey, and one of the earliest collectors of cretaceous specimens in the vicinity of Glen Cove.

Locality: f. 2, Glen Cove; f. 5, Sea Cliff.

PROTÆOIDES DAPHNOGENOIDES Heer. (Pl. 177. f. 1.)

Protæoides daphnogenoides Heer, Phyl. Cret. Neb. 17, *pl. 4. f. 9, 10.*

This is one of the commonest species in the Amboy clays; it has been previously reported by me from Staten Island,* and by Lesquereux from the cretaceous of the West.†

Locality: Sea Cliff.

LAURUS OMALII Sap. et Mar. (Pl. 176, f. 3, 6.)

Laurus Omalii Sap. et Mar. Essai Veg. Marnes Heers. Gelind. 49, *pl. 6, f. 1.*

The reference of this species to the genus *Laurus* appears to me questionable, but as our specimens are apparently identical with the above it is proper that they should be identified with that name. It has not as yet been reported from elsewhere in America.

Locality: f. 3, Sea Cliff; f. 6, Glen Cove.

LAURUS NEWBERRYANA n. sp. (Pl. 179, f. 5.)

Leaf lanceolate, 4 in. long, 1$\frac{3}{8}$ in. wide in middle, entire; lower secondaries leaving the midrib at an acute angle, upper ones at a more obtuse angle.

---

*"The Palæontology of the Cretaceous Formation on Staten Island." Trans. N. Y. Acad. Sci. **11**: 98, *pl. 3, f. 1, 2* (1892); "Additions to the Palæobotany of the Cretaceous Formation on Staten Island." Trans. N. Y. Acad. Sci. **12**: ,36 *pl. 2, f. 4, 9, 13* (1892).

† Cret. Fl. 85, *pl. 15, f. 1, 2.*

It resembles somewhat the leaf described under the name *Laurus Knowltoni* Lesq.,* but is not as long, nor is it as tapering to the apex, and the secondaries are weaker. Named for Professor J. S. Newberry.

Locality: Glen Cove.

SASSAFRAS PROGENITOR Newb. mss. (?) (Pl. 174, f. 1.)

This fragmentary leaf is apparently comparable with the species described under the above name from the Amboy clays by Newberry, and I have thought it best to so refer it, provisionally.

Locality: Oak Neck.

CINNAMOMUM SEZANNENSE Wat. (Pl. 180, f. 5, 7.)

Cinnamomum Sezannense Wat. Pl. Foss. Bass. Paris, 175, *pl. 50, f. 2.*

These leaves are so close to those described as above that I can but consider them identical. Specimens figured by Saporta and Marion† from Gelinden and by Heer‡ from Greenland are even more nearly like ours, and their identity is far more marked than it is between them and the specimens figured by Lesquereux§ from Kansas, which latter more nearly resemble certain forms found in the Amboy clays, described by Newberry under the name *C. intermedium*, n. sp.

Locality: f. 5, Glen Cove; f. 7, Sea Cliff.

DIOSPYROS ROTUNDIFOLIA Lesq. (Pl. 179, f. 2).

Diospyros rotundifolia Lesq. Cret. Fl. 89, *pl. 30, f. 1, 1a.*

This is an exceedingly variable species, if we are to include all the specimens which have been identified with it, and while our specimen cannot be compared with the figures of the type, as above quoted, yet Lesquereux's subsequent figures‖ compare quite satisfactorily with ours.

Locality: Glen Cove.

---

*Fl. Dak. Gr. 94, *pl. 50, f. 4.*

† Rev. Fl. Heers. Gelind. 60, *pl. 9, f. 2–6.*

‡ Fl. Foss. Arct. **6**: 77, *pl. 19, f. 8; 33, f. 11, 12,* and **7**: 30, *pl. 61, f. 1a.*

§ Fl. Dak. Gr. 107, *pl. 12, f. 6, 7.*

‖ Fl. Dak. Gr. 112, *pl. 17, f. 8–11.*

MYRSINE ELONGATA Newb. mss. (Pl. 177, f. 2).

This leaf is evidently identical with those described by Newberry under the above name, from the Amboy clays.

Locality: Lloyd's Neck.

ANDROMEDA PARLATORII Heer. (Pl. 175, f. 2, 5.)

Andromeda Parlatorii Heer, Phyl. Crét. Neb. 18, *pl. 1, f. 5.*

This species, originally described from the cretaceous of Nebraska by Heer, was subsequently found in the West by Lesquereux,* in more or less abundance; by Heer † in Greenland; by David White on Martha's Vineyard,‡ and it is one of the commonest species in the Amboy clays.

Locality: Sea Cliff.

VIBURNUM INTEGRIFOLIUM Newb. mss. (Pl. 177, f. 7.)

This fragment is evidently identical with the specimen described by Newberry under the above name from the Amboy clays. Its reference to *Viburnum* seems more than doubtful, but as it will be eventually published under the above name I have thought it best to retain it in full.

Locality: Glen Cove.

ARALIA TRANSVERSINERVIA Sap. et Mar. (Pl. 176, f. 1.)

Aralia transversinervia Sap. et Mar. Rev. Fl. Heers. Gelind. 79, *pl. 12, f. 4; 14, f. 1.*

I doubt very much whether this leaf ought to be included in the genus *Aralia;* it is more likely to be a *Ficus*, but it is evidently identical with the species described and figured as above.

Locality: Oak Neck.

ARALIA PATENS Newb. mss.(?) (Pl. 174, f. 4.)

This fragment apparently belongs to an *Aralia*, with widely spreading divergent lobes, similar to the species described under the above name by Newberry from the Amboy clays.

Locality: Glen Cove.

---

* Cret. Fl. 88, *pl. 23, f. 6, 7; 28, f. 15;* Fl. Dak. Gr. 115, *pl. 19, f. 1; 52, f. 6.*

† Fl. Foss. Arct. 3: 112, *pl. 32, f. 1, 2;* and 6: 79, *pl. 21, f. 1b, 11; 42, f. 4c.*

‡ "On Cretaceous Plants from Martha's Vineyard." Am. Journ. Sci. (III.) 39: 97, *pl. 2, f. 4* (1890).

Aralia Nassauensis n. sp. (Pl. 174, f. 3, 7.)

Leaves palmately three-lobed, decurrent at base; lobes broad, obscurely and irregularly dentate, pointed; nervation strong, craspedodrome where terminating in the teeth, otherwise camptodrome along the margin; secondaries irregular in location and direction; tertiary nervation and areolation reticulate, forming irregular polygonal meshes.

These two beautifully preserved fragments represent a leaf apparently allied to *A. Looziana* Sap. et Mar.,[*] and *A. Wellingtoniana* Lesq.,[†] which latter has also been found in the Amboy clays. It is clearly, however, neither of these, and Prof. Lester F. Ward, to whom I submitted the drawings for comparison, considers it a new species, identical with specimens of his own collecting, from the vicinity of Washington, D. C., in the new Pennsylvania Avenue extension.

Named for Nassau, the old name for Long Island.

Locality: Brooklyn, *fide* specimens in the cabinet of the Long Island Historical Society. f. 3, "Throop Avenue and Kosciusko Street, 12 ft. below surface, W. Miles; f. 7, "Brevoort Pl. 6, ft. below surface, J. C. Brevoort."

Myrtophyllum (Eucalyptus?) Geinitzi Heer. (Pl. 177, f. 11.)

Myrtophyllum Geinitzi Heer, Fl. Foss. Arct. **3**: 116, *pl. 32, f. 14–17; 33, f. 6b;* and **6**: 93, *pl. 19, f. 1c; 45, f. 4–9; 46, f. 12c, d, 13.*

This species is apparently one of the most abundant in the cretaceous of the East. It was previously reported by me from Long Island,[‡] and from two localities on Staten Island;[§] it is abundant, at three different localities in the Amboy clays, and is one of the species mentioned by White as occurring on Martha's Vineyard.[||] It is also described by Heer from Moletein,[¶] and by Lesquereux from the West.[**]

Locality: Glen Cove.

---

[*] Rev. Fl. Heers. Gelind. 77, *pl. 13, f. 1–3.*

[†] Fl. Dak. Gr. 131, *pl. 21, f. 1; 22, f. 2, 3.*

[‡] Trans. N. Y. Acad. Sci. **12**: 236, *pl. 6, f. 2* (1893).

[§] Trans. N. Y. Acad. Sci. **11**: 98, *pl. 2, f. 1* (1892); and **12**: 34, *pl. 2, f. 5* (1892).

[||] Am. Journ. Sci. (III.) **39**: 98, *pl. 2, f. 8–11* (1890).

[¶] Kreide Fl. Moletein, 22, *pl. 11, f. 3, 4.*

[**] Fl. Dak. Gr. 138, *pl. 37, f. 20.*

EUCALYPTUS? NERVOSA Newb. mss. (?) (Pl. 174, f. 10.)

This fragment apparently represents an almost linear leaf, similar to such as have been described under the above name by Newberry from the Amboy clays. Or it may be a portion of *E. Dakotensis* Lesq. (Fl. Dak. Gr. 137, *pl. 37, f. 14–19*). Its reference to the species which is described from the East would seem, however, to be the most likely.

Locality: Sea Cliff.

HYMENÆA DAKOTANA Lesq. (?) (Pl. 176, f. 4).

Hymenæa Dakotana Lesq. Fl. Dak. Gr. 145, *pl. 55, f. 2, 3; 56, f. 1. 2; 62, f. 2.*

Our specimen, although somewhat larger, agrees quite closely with the species as above described, and I have so referred it provisionally.

Locality: Sea Cliff.

COLUTEA PRIMORDIALIS Herr. (Pl. 174 f. 2.)

Colutea primordialis Heer, Fl. Foss. Arct. 6: 99, *pl. 27, f. 7–11; 43, f. 7, 8.*

Ours is apparently a large specimen of this species, agreeing quite closely with the specimen figured by Heer, *loc. cit. pl. 27, f. 11.* This was the only well defined leaf found on Eaton's Neck, and is practically our only voucher for the existence of the cretaceous formation at that locality. It has been found in the Amboy clays at Woodbridge and in the cretaceous of the West.*

Locality: Eaton's Neck.

LEGUMINOSITES CONVOLUTUS Lesq. (?) (Pl. 177, f. 14.)

Leguminosites convolutus Lesq. Fl. Dak. Gr. 151, *pl. 44, f. 4.*

This fragment is manifestly too small to form the basis for a new species, and if referred provisionally to any described species, the above would seem to be its proper place.

Locality: Glen Cove.

LEGUMINOSITES CONSTRICTUS Lesq. (?) (Pl. 177, f. 13.)

Leguminosites constrictus Lesq. Fl. Dak. Gr. 151, *pl. 44, f. 3.*

It is unfortunate that the apex of our specimen is missing, but the general appearance seems sufficiently close to warrant its provisional reference to the above species.

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* Fl. Dak. Gr. 148, *pl. 13, f. 8, 9.*

Locality: Oak Neck.

SAPINDUS MORRISONI Lesq. (Pl. 179, f. 8.)

Sapindus Morrisoni Lesq. Cret. and Tert. Fl. 83, *pl. 16, f. 1, 2.*

If all the specimens which have been referred to this species have been correctly identified it is one of the most widely distributed species in America. It has not been found in the Amboy clays, but it has been previously reported by me from Long Island * and Staten Island; † by White from Martha's Vineyard; ‡ by Heer from Greenland; § as well as from its place of original discovery in the West.

Locality: Glen Cove.

CISSITES FORMOSUS Heer.(?) (Pl. 174, f. 6.)

Cissites formosus Heer, Fl. Foss. Arct. **6**: 85, *pl. 21, f. 5–8.*

This fragment is too imperfect for anything more than provisional determination, and it is placed under the above name with some misgivings. The species has been found in considerable numbers, however, in the Amboy clays, and is reported from the cretaceous of Kansas by Lesquereux.||

Locality: Dosoris Island, Glen Cove.

PALIURUS INTEGRIFOLIUS n. sp. (Pl. 177, f. 5, 8, 12.)

Leaves variable in size, (1 in.–3 in. long, ¾ in.–2½ in. wide,) rounded at the base, entire; nervation palmate, symmetrical; midrib and lateral primaries about equally strong, only slightly divergent; secondaries from the lateral primaries strong, ascending at an acute angle, the lowest ones curved, the upper almost straight and apparently loosing themselves in the parenchyma of the blade.

It is with some hesitation that I have included these three specimens under one species. They may each represent a distinct species, but as only the bases of each are preserved, I have thought it best to group them together provisionally, in the hope

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* Trans. N. Y. Acad. Sci. **12**: 235, *pl. 6, f. 3* (1893).

† Trans. N. Y. Acad. Sci. **11**: *pl. 3, f. 5* (1892).

‡ Am. Journ. Sci. (III.) **39**: 99, *pl. 2, f. 12* (1890).

§ Fl. Foss. Arct. **6**: 96, *pl. 40, f. 1; 41, f. 3; 43, f. 1a, b; 44, f. 7, 8.*

|| Fl. Dak. Gr. 161, *pl. 21, f. 5.*

that more complete material may be collected in the future, when we may be able to differentiate them.

Locality: f. 5, Lloyd's Neck; f. 8, Glen Cove; f. 12, Oak Neck.

Zizyphus elegans n. sp. (Pl. 177, f. 9, 10.)

Leaves ovate, varying in size, (about 1 in. long, $\frac{11}{16}$ in. or less wide), entire, symmetrical; nervation palmate; midrib slender, sparingly branched above; lateral primaries more slender, curving strongly from the base upward, branched on the outside, branches curving upward, all apparently eventually loosing themselves in the parenchyma of the blade.

Numerous fragments of these beautiful little leaves were found, which I have been unable to refer to any described species.

Locality: Glen Cove.

Zizyphus Lewisiana n. sp. (Pl. 180, f. 13.)

Leaf narrowly lanceolate-falcate, entire; about $1\frac{3}{4}$ in. long, including the short petiole, $\frac{3}{8}$ in. wide at about the middle; tapering to the apex and rounding to the base; nervation palmate; midrib slender but prominent; lateral primaries thin, connected with the secondaries from the midrib and forming a series of loops along the margin at a distance of about $\frac{1}{16}$ in. from it.

Named for Mr. Elias Lewis, Jr., to whom we are indebted for much careful work in the geology of Long Island.

Locality: Oak Neck.

Rhamnus (?) acuta Heer. (Pl. 177, f. 6.)

Rhamnus(?) *acuta* Heer. Fl. Foss. Arct. **6**: 98, *pl. 41, f. 6;* and *45, f. 13c.*

This specimen is apparently identical with the species described as above by Heer, from Greenland. I do not know that it has been elsewhere reported from America.

Locality: Lloyd's Neck.

Celastrophyllum Benedeni Sap. et Mar. (Pl. 177, f. 3, 4.)

Celastrophyllum Benedeni Sap. et Mar. Essai. Veg. Marnes Heers. Gelind. 67, *pl. 10, f. 6;* and *12, f. 1*, 2.

This specimen has been compared with several species of *Celastrophyllum* from the Amboy clays and elsewhere, but its identity with the above seems to be beyond question, and if so, this is its first reported occurrence in America.

Locality: Glen Cove.

CELASTROPHYLLUM DECURRENS Lesq. (?) (Pl. 179, f. 1.)

Celastrophyllum decurrens Lesq. Fl. Dak. Gr. 172, *pl. 36, f. 1.*

I am inclined to think that this is an imperfectly preserved specimen of the above species in which the fine serrations and narrow decurrent petiole are not apparent; or it may represent the species described by me from Staten Island under the name *Myrica grandifolia.* (Trans. N. Y. Acad. Sci. 12: 32, *pl. 3, f. 1.* (1892).) A specimen with more perfectly preserved margin could alone determine these points.

Locality: Glen Cove.

GREWIOPSIS VIBURNIFOLIA Ward. (Pl. 174, f. 8.)

Grewiopsis viburnifolia Ward, Bull. 37, U. S. G. S. 89, *pl. 40, f. 2.*

This appears to be without doubt a small specimen of the above species, described by Ward from the Laramie of Montana. It also has the appearance, were it not for the small size, of certain species of *Platanus*, (*P. Newberryana* Heer, Fl. Foss. Arct. 7: *pl. 59, f. 6*), from the Patoot beds of Greenland. It might also be compared with *Viburnum*, as indicated by Ward in his discussion of the type. It is the only specimen of its kind which I have yet seen from the eastern United States.

Locality: Lloyd's Neck.

MENISPERMITES BRYSONIANA n. sp. (Pl. 180, f. 10.)

Leaf inequilateral, entire, broadly cordate at base, widest at about one-third the distance from base to tip, thence rapidly narrowing; dimensions about 3½ in. long by 1¾ in. wide at broadest part, one side only slightly curved, the other conspicuously so; nervation consisting of a midrib, which is nearest to the side with least curve, a strong lateral nerve, which originates at a distance of about $\frac{3}{16}$ in. from the base and curves towards the outer side, and several secondaries, which also spring at irregular intervals from the midrib.

It has much the general appearance in outline of the fragment of *M. borealis* Heer, described and figured in Fl. Foss. Arct. **6**: 91, *pl. 39, f. 2*, from the lower Atane beds of Greenland, and with similar leaves from the Amboy clays of New Jersey. Our specimen, however, is smaller than any of these, and apparantly has but a single strong lateral nerve, whereas all the others mentioned have two or more.

Named for Mr. John Bryson, who has performed valuable service in the study and interpretation of geological phenomena on Long Island.

Locality: Glen Cove.

MAGNOLIA SPECIOSA Heer. (Pl. 178, f. 5.)

Magnolia speciosa Heer, Kreide Fl. Moletein, 20, *pl. 6, f. 1; 9, f. 2; 10, f. 1, 2; 11, f. 1.*

This species was previously reported by me from Glen Cove,* and has been identified in the cretaceous of the West by Lesquereux.†

Locality: Glen Cove.

MAGNOLIA ISBERGIANA Heer. (Pl. 178, f. 4.)

Magnolia Isbergiana Heer, Fl. Foss. Arct. **6**: 91, *pl. 36, f. 3.*

Although our specimen is in a somewhat fragmentary condition, the broad abruptly-curving base would seem to make it referable to the above species, and if so this is the first record of its occurrence in the United States.

Locality: Glen Cove.

MAGNOLIA LONGIPES Newb. mss. (Pl. 178, f. 1, 3.)

These two fragmentary specimens are apparently referable to the species described under the above name by Newberry from the Amboy clays.

Locality: f. 1, Glen Cove; f. 3, Dosoris Island.

MAGNOLIA GLAUCOIDES Newb. mss. (Pl. 175, f. 1, 7.)

Prof. Newberry has described, from the Amboy clays, a new species of *Magnolia* under the above name, which appears to be identical with the specimens here figured. It is unfortunate that the nervation in the Amboy specimens is not well preserved, but the general appearance is so close, and the identity of each with *Magnolia* seems so plain, that their reference to the same species seems imperative. It is evidently closely allied to *M. Boulayana* Lesq. Fl. Dak. Gr. 202, *pl. 60, f. 2.*

Locality: Sea Cliff.

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* Trans. N. Y. Acad. Sci. **12**: 234, *pl. 7, f. 4*; (1893).

† Cret. and Tert. Fl. 72; Fl. Dak. Gr. **202**, *pl. 60, f. 3, 4.*

MAGNOLIA AURICULATA Newb. mss. (Pl. 179, f. 6, 7.)

Amongst the commonest of the Amboy clay species are certain very variable leaves which Newberry has described under the above name. In typical specimens the base of the leaf is auriculate, as it is in f. 7; in others the base is slightly decurrent, as in f. 6. Close comparison with a large number of specimens seems to warrant the reference.

Locality: Glen Cove.

MAGNOLIA VAN INGENI n. sp. (Pl. 175, f. 6.)

Leaf narrowly oblong, tapering equally to base and apex; margins almost parallel in the middle, entire; length about $4\frac{1}{2}$ in., width about $1\frac{3}{8}$ in.; petioled; petiole about 1 in. long; midrib narrow; secondaries fine, irregular, camptodrome near the margin and connected throughout by numerous fine loops and cross reticulations.

Resembles *M. glaucoides*, but is much narrower. Named for Mr. Gilbert Van Ingen, the collector.

Locality: Sea Cliff.

LIRIODENDRON PRIMÆVUM Newb. (Pl. 179, f. 4.)

Liriodendron primævum Newb. Later Extinct Floras, Ann. Lyc. Nat. Hist. N. Y. **9**: 12 (1868); and Illust. Cret. & Tert. Pl. *pl. 6, f. 7.*

This imperfect specimen apparently represents one of the many forms which this species assumes, under which it has received the names of *Leguminosites Marcouanus* Heer, *Phyllites obcordatus* Heer, *Liriodendron Meekii* Heer, etc., from the West and from Greenland.* It has also been found by me on Staten Island† and in the Amboy clays (?).

Locality: Glen Cove.

LIRIODENDRON SIMPLEX Newb. (Pl. 179, f. 9.)

Liriodendron simplex Newb. Bull. Torr. Club, **14**: 6, *pl. 62, f. 2, 3, 4* (1887).

This is apparently the most abundant of all our cretaceous species in America. It is often difficult to separate from the prev-

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*See *L. Meekii* and its varieties in Fl. Foss. Arct. **6**: 87–90, *pl. 18, f. 4c; 22, f. 2–13; 23, f. 3–8; 25, f. 5a.; 45, f. 13a, b.*

†Trans. N. Y. Acad. Sci. **11**: *pl. 2, f. 8?* (1892), and **12**: 35, *pl. 3, f. 4* (1892).

ious one. It is common in the Amboy clays, on Staten Island,* Long Island,† Martha's Vineyard,‡ Greenland and in the West. As in the previously described species it may also be identified in some of the forms of *L. Meekii* Heer, and *Sapotacites retusus* Heer, from Greenland,§ and as *Sapotacites Haydeni* Heer and *Phyllites obcordatus* Heer, from the West.||

Locality: Glen Cove.

LIRIODENDRON OBLONGIFOLIUM Newb. mss. (Pl. 179, f. 3.)

This is apparently a fragment of the species described by Newberry under the above name from the Amboy clays.

Locality: Glen Cove.

PLANT REMAINS OF UNCERTAIN AFFINITIES.

On Plate 180 may be seen a number of fragmentary remains, whose exact botanical affinities it would be very difficult to state.

f. 1. Apparently a winged seed or samara. It is too symmetrical for *Pinus*, but may represent one wing or lobe of the organism described by Newberry under the name *Tricalycites papyraceus*, from the Amboy clays, a specimen of which is figured on this plate and described further on. Or, if it were not for the well-defined nucleus at the base, I should be inclined, perhaps, to consider our specimen as a leaf of some species of *Podozamites* or *Pterophyllum*, such for example as *Pterophyllum* (?) *Haydeni* Lesq. Cret. Fl. 50, *pl. 1, f. 6, 6b.*

Locality: Glen Cove.

f. 4. This is a fragment of some leaf with well defined parallel nervation, and might be referred to some species of *Podozamites*, many of which are found in the Amboy clays.

Locality: Glen Cove.

f. 2, 3, 12. These specimens of parallel nerved leaves were selected from a large number collected. They may be considered as monocotyledones, and could be more or less successfully com-

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* Trans. N. Y. Acad. Sci. **11**: 98, *pl. 2, f. 2–7, 9* (1892).

† Trans. N. Y. Acad. Sci. **12**: 235, *pl. 5, f. 1–5;* and *7, f. 2, 3* (1893)

‡ Am. Journ. Sci. (III.) **39** : 98, *pl. 2, f.* 6, 7 (1890).

§ See previous reference and Fl. Foss. Arct. 7: 32, *pl. 61, f. 10;* 38, *pl. 63, f. 6.*

|| Illust Cret. and Tert. Pl. *pl. 5, f. 1–3.*

pared with species which have been figured under the genera *Poacites* Brong., *Cyperites* Lindl. and Hutt., *Phragmites* Trin., etc.* I do not think it wise, however, to refer them definitely in their fragmentary condition.

Locality: Glen Cove.

f. 11. This is a fragment of a fruit, composed of round carpels or spores. It has somewhat the appearance of *Caulinites fecundus* Lesq. Tert. Fl. 101, *pl. 14, f. 1–3*, but further than this I would not hazard a conjecture.

Locality: Glen Cove.

f. 9. These two fragments might be provisionally referred to *Typha* and perhaps to *T. latissima*, A. Br. Ettingsh. Foss. Fl. Bilin, 30, *pl. 6, f. 9a, b, 10.*

Locality: Lloyd's Neck.

f. 8. This is evidently an imperfect specimen of the organism described by Newberry from the Amboy clays under the name *Tricalycites papyraceus.* It is a dicotyledone of unknown affinities.

Locality: Lloyd's Neck.

f. 6. Apparently a portion of an ament or catkin of some dicotyledone, probably a *Salix* or a *Populus.* Inasmuch as several species of the former are well recognized in our cretaceous flora, such reference would probably be correct.

Locality: Glen Cove.

Explanation of Plates.

PLATE 174.

Fig. 1. *Sassafras progenitor* Newb. mss. (?) Oak Neck.
Fig. 2. *Colutea primordialis* Heer. Eaton's Neck.
Figs. 3, 7. *Aralia Nassauensis* n. sp. Brooklyn.
Fig. 4. *Aralia patens* Newb. mss. (?) Glen Cove.
Fig. 5. *Salix proteæfolia flexuosa* Lesq. Sea Cliff.
Fig. 6. *Cissites formosus* Heer. (?) Dosoris Island.
Fig. 8. *Grewiopsis viburnifolia* Ward. Lloyd's Neck.

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* *Poacites Mengeanus* Heer, Fl. Foss. Arct. **2**: 466, *pl 55, f. 9, 10a, b.*
Poacites arundinarius Ettingsh. Foss. Fl. Bilin, 24, *pl. 5, f. 3–5, 16.*
Cyperites deperditus Wat. Pl. Foss. Bass. Paris, 69, *pl. 18, f. 3.*
Cpyerites borealis Heer, Fl. Foss. Arct. **1**: 96, *pl. 45, f. 3, 3b.*
Phragmites Oeningensis Al. Br.; Heer in Fl. Foss. Arct. **1**: 96, *pl. 3, f. 6–8*; and *45, f. 6*, etc.

Fig. 9. *Salix purpuroides* n. sp. Sea Cliff.
Fig. 10. *Eucalyptus ? nervosa* Newb. mss. (?) Sea Cliff.

PLATE 175.

Figs. 1, 7. *Magnolia glaucoides* Newb. mss. Sea Cliff.
Figs. 2, 5. *Andromeda Parlatorii* Heer. Sea Cliff.
Fig. 3. *Juglans crassipes* Heer. Brooklyn.
Fig. 4. *Ficus protogæa* Heer. (?) Glen Cove.
Fig. 6. *Magnolia Van Ingeni* n. sp. Sea Cliff.

PLATE 176.

Fig. 1. *Aralia transversinervia* Sap. et Mar. Oak Neck.
Figs. 2, 5. *Ficus Willisiana* n. sp. f. 2, Glen Cove; f. 5, Sea Cliff.
Figs. 3, 6. *Laurus Omalii* Sap. et Mar. f. 3, Sea Cliff; f. 6, Glen Cove.
Fig. 4. *Hymenæa Dakotana* Lesq. (?) Sea Cliff.

PLATE 177.

Fig. 1. *Protæoides daphnogenoides* Heer. Sea Cliff.
Fig. 2. *Myrsine elongata* Newb. mss. Lloyd's Neck.
Figs. 3, 4. *Celastrophyllum Benedeni* Sap. et Mar. Glen Cove.
Figs. 5, 8, 12. *Paliurus integrifolius* n. sp. f. 5, Lloyd's Neck; f. 8, Glen Cove; f. 12, Oak Neck.
Fig. 6. *Rhamnus* (?) *acuta* Heer. Lloyd's Neck.
Fig. 7. *Viburnum integrifolium* Newb. mss. Glen Cove.
Figs. 9, 10. *Zizyphus elegans* n. sp. Glen Cove.
Fig. 11. *Myrtophyllum* (*Eucalyptus ?*) *Geinitzi* Heer. Glen Cove.
Fig. 13. *Leguminosites constrictus* Lesq. (?) Oak Neck.
Fig. 14. *Leguminosites convolutus* Lesq. (?) Glen Cove.

PLATE 178.

Figs. 1, 3. *Magnolia longipes* Newb. mss. f. 1, Glen Cove; f. 3, Dosoris Island.
Fig. 2. *Juglans arctica* Heer. (?) Glen Cove,
Fig. 4. *Magnolia Isbergiana* Heer. Glen Cove.
Fig. 5. *Magnolia speciosa* Heer. Glen Cove.

PLATE 179.

Fig. 1. *Celastrophyllum decurrens* Lesq. (?) Glen Cove.
Fig. 2. *Diospyros rotundifolia* Lesq. Glen Cove.
Fig. 3. *Liriodendron oblongifolium* Newb. mss. Glen Cove.
Fig. 4. *Liriodendron primævum* Newb. Glen Cove.
Fig. 5. *Laurus Newberryana* n. sp. Glen Cove.
Figs. 6, 7. *Magnolia auriculata* Newb. mss. Glen Cove.
Fig. 8. *Sapindus Morrisoni* Lesq. Glen Cove.
Fig. 9. *Liriodendron simplex* Newb. Glen Cove.

PLATE 180.

Fig. 1. Winged seed ? Glen Cove.
Figs. 2, 12. *Poacites ?* Glen Cove.
Fig. 3. *Cyperites ?* Glen Cove.

Fig. 4. *Podozamites ?* Glen Cove.
Figs. 5, 7. *Cinnamomum Sezannense* Wat. f. 5, Glen Cove; f. 7, Sea Clift.
Fig. 6. Catkin of *Salix ?* Glen Cove.
Fig. 8. *Tricalycites papyraceus* Newb. mss. Lloyd's Neck.
Fig. 9. *Typha ?* Lloyd's Neck.
Fig. 10. *Menispermites Brysoniana* n. sp. Glen Cove.
Fig. 11. Fruit. Glen Cove.
Fig. 13. *Zizyphus Lewisiana* n. sp. Oak Neck.

Contributions to American Bryology, V.

By Elizabeth G. Britton.

NOTES ON THE NORTH AMERICAN SPECIES OF WEISSIA (ULOTA).

WEISSIA CURVIFOLIA (Wahl.) Lindb.

Orthotrichum curvifolium Wahl. Fl. Lapp. 365 (1812).
Ulota curvifolia Brid. Bryol. Univ. 1: 302 (1826).
Ulota Americana Mitt. Journ. Linn. Soc. 8: 26 (1865).

Ulota Americana, Mitt. was described from specimens collected by Drummond and distributed as No. 153, labeled *Orthotrichum crispum*, Hedw. The habitat is given as "On trees in Upper Canada; and upon rocks called Hell's Gates, below Norway House." As the label indicates, the specimens are mixed; and Mitten states that in his set *U. Bruchii*, not *U. crispa*, was distributed. In our set there are two distinct patches, the one on the right evidently grew on trees, for it contains *U. crispa* and *Orthotrichum speciosum*. The other piece grew on rocks. At first sight, from its darker color, and less curly leaves, it would seem to be *U. Hutchinsiæ*, and it is with this species that Venturi compared it in the Revue Bryologique (1892), as it was part of this specimen that I sent to him at that time. He says that "the character which distinguishes it from *U. Hutchinsiæ* is in leaves which are not erect appressed, but distinctly curved as in the leaves of *U. curvifolia*." Now it is with the latter species that the comparison should have been made, and I think that Dr. Venturi would have come to the same conclusion that I have, that they are the same species.

I have compared our specimens with the description of *U. curvifolia* given by Limpricht in the Laumboose p. 28, and find only one discrepancy, he says the cilia have only one row of cells, ours have two. Schimper figures *U. curvifolia* in the Bryologia Europæa with two, and the Manual states they have two. I have also compared the leaves with those of *U. curvifolia*, from Rabenhorst's Bryotheca Europæa, Nos. 182 and 222, and with our specimens they are identical. In this connection it will be remembered that the Manual says that *U. curvifolia* has been collected by Drummond in North America, credited by Schimper. I sent to Kew to ask if Schimper's specimens were numbered, but they are not. In one of Drummond's sets at Kew, however, there is the same mixture of specimens as in our No. 153.

I have appealed to Mr. Mitten twice to reconsider this question, and sent him a portion of our specimen of Drummond's No. 153, but he has not done so. Therefore we must reason the question out for ourselves. Mitten says in his original description that *U. Americana* "differs from *U. curvifolia*, Wahl., in the areolation of the base of the leaf and from *U. crispa* and *U. crispula* in the same particular, as well as in the form of the base of the leaves." Now evidently the first comparison was with the species to which he considered it most closely allied, the second with the species with which the specimens were mixed and confused in distribution. It is to the latter group, however, that Lesquereux and James in the Manual referred it, as in their set they had only a tree species, allied to *U. crispa.*

Macoun's set also has only *U. crispa.* Of course it is possible that Mitten did find a different species mixed in his 153, from the ones which I have found in our set and Hooker's set at Kew, but it will be remembered that it has not been collected since. Whereas *U. curvifolia* has been collected on the shore of Lake Huron by Macoun, and one of the localities given by Mitten for *U. Americana*, is Lake Huron collected by Todd.

The original description reads as follows:

" *Ulota Americana*, Monoica, foliis siccitate tortis appressis e basi subovali longe lanceolatis sensim acutis nervo carinatis marginibus recurvis, saepe suberosis, cellulis basi ad margines seriebus circiter hyalinis oblongis, in media angustis luteis, e superioribus rotundatis diametro circiter $\frac{1}{4000}$ unciae metientibus perichaetialibus apice latioribus obtusiusculis, theca elliptica plicata, operculo conico acuminato, peristomio dentibus bigeminatis 8, ciliis aequilongis angustis 8, calyptra breviter appresse ramentosa."

Now as Venturi says, in the Revue Bryologique, our specimens of 153 agree with this description, and the erose margins of the upper part of the leaves is due to the prominent papillæ. Therefore unless Mitten can prove it to the contrary, I will mantain the synonymy as given above.

Prof. Macoun in his Catalogue says he has "never observed a species of *Ulota* that grew indiscriminately on rocks and trees, and therefore proposes to place *U. Americana* at Hell's Gate, and hence a rock species," but he makes the same mistake that Limpricht in his Laubmoose does, and refers to it *U. Hutchinsiæ* as well, citing also Drummond's No. 147, evidently without critically comparing the specimens. Now *U. Hutchinsiæ*, though usually a rock species does occasionally grow on tress, according to Limpricht, l. c., and we have specimens from E. Faxon collected at Brookline, Mass., on trees, as also from A. Commons, near Wilmington, Delaware. Austin collected it on trees near Closter, and last summer I sent to Venturi specimens from the summit of White Top Mountain, Virginia, that grew in dense spruce woods both on rocks and trees, and he pronounced them the same as European *Hutchinsiæ*, though at the time I did not feel satisfied to call them that species.

ULOTA SCABRIDA KINDB. Macoun. Cat. Can. Pl. 6, 83 (1892).

In Macoun's Canadian mosses No. 115 was distributed as *U. Americana*, but later in the Catalogue it was described as a new species, *U. scabrida*, Kindb., on acconnt of its densely papillose leaves. These specimens in our set are very papillose, with erose margins, and they seem to me to agree with Drummond's No. 153, as nearly as young *Ulotas* will agree with older specimens of the same species. Furthermore the specimens agree with Kindberg's description as far as it goes, though I cannot assent to his comparisons, for he seems to me to have said the reverse of what he should have said, when he states that they resemble *U. crispa* more than *U. curvifolia*, and are not much allied to the latter. I have compared them with specimens of *U. curvifolia*, collected by Breidler, in the Austrian Alps, and with Limpricht's description in his Laubmoose, and *U. scabrida* differs in having a longer, more slender beak to the lid, and the cilia are of two rows of cells, not one as described by Limpricht. Why the comparison with *U. crispa* was made at all I do not understand, seeing the species grew on rocks, and the leaves are not circinnate, unless Macoun has distributed a totally different set of specimens from the ones that were seen by Kindberg. The following measurements and description may enable some other students to determine whether their specimens are the same as in our set.

Leaves "comparatively short as in *U. curvifolia*" (1.5–2.5 mm), "basal cells elongate, alar" (inflated), (5–7 rows of) "marginal distinct and hyaline. Capsule sub-oblong" (less than 1 mm. long) "passing into a long collum" (constricted at neck when dry) "teeth not reflexed, pale" (bigeminate, striolate, perforate, cilia 8, as long as the teeth, of two rows of cells, mouth bordered above the insertion of the peristome, bands of the capsule of four rows of large cells), "calyptra lobate, very hairy" (hairs papillose), "pedicel long" (2 mm., exserted). The parts of the description in brackets are mine. Now Drummond's 153 shows no lid, but in all else they agree with *U. scabrida.* Macoun collected the specimens in the Rocky Mountains near Hector.

It may be that Kindberg in describing *U. scabrida* as a new species different from *U. Americana* Mitt., as it was originally distributed, thought that the latter species was related to *U. crispa*, as the Manual says, but even then I do not understand his comparison.

WEISSIA AMERICANA (Beauv.) Lindb.

Orthotrichum Americanum Beauv. Prodr. 81 (1805).
Orthotrichum Hutchinsiæ J. E. Smith, Eng. Bot. *t. 2523* (1813).
Orthotrichum strictum Brid. Bryol. Univ. 1: 289 (1826).
Ulota Hutchinsiæ Hammar, Mon. Orth. Suec. 27 (1852).
Weissia Americana Lindb. Musc. Scand. 28 (1879).
Ulota Americana Limpricht; Rab. Kryptfl. 4: Part 2, 21 (1890) not Mitten.

Through the kindness of M. Autran, of the Boissier Herbarium, I have seen the specimens from which Schwægrichen figured *Orthotrichum Americanum*, Beauv., in the Supplement table 138 (1824), and find mounted on the same sheet portions of the type received from Beauvois. They were collected in Pennsylvania by Muhlenberg, and are identical with the species which we have been calling *U. Hutchinsiæ* in North America.

The confusion which has arisen is in consequence of the use of the same specific name by Mitten for *U. curvifolia* (*U. Americana*, Mitt.) 59 years after it had been used by Palisot de Beauvois for *U. Hutchinsiæ*. With singular fatality it has spread into every modern text-book, catalogue and magazine which has referred to the subject, even to the last report of the American Naturalist of the Proceedings of the Madison meeting, where I am made to say just the opposite of what I did say. Braithwaite in his British mosses is the only one who seems to have understood Lindberg correctly, and he cites *Weissia Americana* (Beauv.) Lindb. for *Ulota Hutchinsiæ*, Smith, and does not refer to *Ulota Americana*, Mitt.

The unfortunate part of it is that Limpricht in the Laubmoose (part 14, page 21, 1890) should have made the mistake of citing Mitten's *Ulota Americana* in connection with this species, and that Venturi in the Revue Bryologique should not have made the comparison of the specimens which I sent him with *U. curvifolia*, and not with *U. Hutchinsiæ*.

WEISSIA AMERICANA RUFESCENS n. var.

Plants more slender, green or brown not black, stems rufous tomentose, leaves less crowded, longer, often 3 cm. narrower, acuminate, upper cells more dense and obscure, lower golden brown, rectangular, not linear or sinuous, marginal shorter, not hyaline; seta 2 mm. long, neck tapering .75 mm. stomata few, small, theca pyriform, 1.5 long by 1 mm. broad, inflated, narrower at the mouth, ridges continuous of 3–6 rows of cells, broadest at the mouth, not prominent on mature capsules; peristome double, teeth reflexed when dry, white granulose, not trabeculate at apex, cilia eight of two rows of cells, fugacious; calyptra with short, glossy papillose hairs.

Summit of White Top, on trees in dense woods of *Picea Mariana* and *rubra*, mixed with *Dicranum longifolium*, *Zygodon viridissimus*, *W. ulophylla* and *Frullania Asa-Grayana*. Alt. 5,678 ft.

Differing in habitat and general aspect from the common form which grows on old stone fences, on erratic boulders and stones in woods forming black patches with *Hedwigia*; from var. *nigritum*, (Br. & Sch.) Limpr., in the presence of cilia, and its habit of growing on trees in shade.

This is another of the cases so frequent in this genus, where the macroscopic differences are more distinct than the microscopic. We also have specimens collected at Raquette Lake, in the Adirondack Mountains N. Y., which at first sight resemble *W. curvifolia* more than *W. Americana*, but when compared with the normal form of the latter agree in the less papillose leaves, though having the brown color, slender stems and short capsules like the former. The leaves however are not as curved. Prof. Macoun has collected specimens "on trees at Goulay's Point, Lake Superior," which also differ quite markedly from the dense black form with elongated capsules of our Eastern States.

In Sullivant's herbarium there are also duplicates of these specimens labelled "*U. Hutchinsiæ*," with the following note. "Macoun's No. 33 from Goulay's Point, Aug. 5, 1869. Capsule and pedicel not as figured in Br. Eu. Looks like U. Barclayi, Mitt.—See slide.—W. S. S."

WEISSIA COARCTATA (Beauv.) Lindb.

Orthotrichum coarctatum Beauv. Prod. 80 (1805).

Ulota Ludwigii Brid. Mant. 112 (1819).

Lindberg and Braithwaite cite the above synonymy. Limpricht doubts whether it is correct, cites *O. coarctatum* with a ? and says that the plant figured by Schwægrichen (Suppl. I. ii. 26, t. 52) is a different species. He cites this plate under *U. Bruchii*. The original description reads as follows:

Orth. coarctatum; caule suberecto ramoso, ramis inclinatis; foliis linearibus, siccitate crispis, costa integra notatis; pyxidibus erectis, pyriformibus; orificio striato, coarctato; calyptra pallida, hirta.

J'ai rapporté cette espèce de l'Amérique septentrionale. Elle a quelque rapporte avec *l'Orth. crispum;* mais elle en difère par la forme de l'urne et son orifice strié et rétréci.

It will be noted that the leaves are described as crisped, and that the plants are compared to *O. crispum;* but, on the other hand, the description of the capsules ageees with that of *U. Ludwigii.*

Schimper, in the Bryologia Europea, *t. 227*, figured for *Orthotrichum coarctatum*, Beauv., the species which Bridel (Bryol. Univ.

1 : 794, 1816) described as *Ulota Bruchii.* In the second edition of Schimper's Synopsis Muscorum (p. 301, 1876) he corrected this, and cites *O. coarctatum* Beauv. as a synonym of *U. Ludwigii*, and says that it agrees with the original description but not with Schwægrichan's figures. Under *U. Ludwigii,* he says that *O. coarctatum* (Beauv. et Schwægr.) which he united with *Bruchii* is a distinct species.

The plates in Schwægrichen's Supplement referred to show *U. Ludwigii* as we now understand it, and *t. 52* seems to be quite different. The capsules are quite unlike the previous plate of *Ludwigii*, but they do not seem long enough nor tapering enough to be *U. Bruchii.* It would be hard to say what they were meant for, though they are not *U. Ludwigii.* The locality given is on trunks of trees, communicated by Persoon and Richard from North America, mixed with *O. crispum.* Now *U. Bruchii* has a northerly range, and is rather a rare species. We have it from Canada and Alaska. *U. Ludwigii* and *crispa* are common and range down the Alleghenies to Georgia, frequently growing mixed together. I have sent specimens to the Delessert Herbarium, and asked to have the comparisons made for me; but we learn from M. Briquet, that none of Palisot de Beauvois' mosses are to be found in the Delessert Herbarium, so that we must accept the plate and explanation given by Schewaegrichen, that *O. coarctatum* is the same as *U. Ludwigii*, and that it grew mixed with *U. crispa* and that would account for the description given by Beauvois.

WEISSIA PHYLLANTHA (Brid.) Lindb.

Ulota phyllantha Brid. Mant. 113 (1819).

Weissia phyllantha Lindb. Musc. Scand. 28 (1879).

As no description of the fruit of this species has been published in any American periodical, it seems desirable to give it from the specimens from which it was originally described, supplemented by later observations from better specimens. Mr. Howell, sent two patches, measuring 3 inches across, each of which bore a few capsules, but they were so old and infested by fungi that I had great difficulty in securing a good peristome.

Plants diœcious, antheridia in superposed buds at intervals of 1 cm. apart; seta 4–5 mm. long, twisted to the right, erect or curved when dry; capsule 1–2 mm. long, ridges 8, of 4–6 rows of cells;

neck long, tapering; stomata abundant at the base of the sporesac, lid conic apiculate; peristome double, teeth recurved when dry, united in pairs, white, granulose-striolate, cilia 8, fugacious, a little shorter than the teeth of two rows of cells; calyptra 2 mm. long, hairs short appressed.

On trees Yaquima Bay, Oregon, Howell, New West Junction, Macoun in fruit.

All the Eastern specimens of this species are sterile, though it has been collected in Mt. Desert, Maine, by Mr. White; in Anticosti and Nova Scotia, by Macoun; Newfoundland, Waghorne. It has also been collected in fruit in Europe, at Killarney, by Schimper, and in the Jæger herbarium there is one specimen collected by Jensen in 1851, in Insula Mona, Denmark, labelled *O. Jutlandicum*, which has seven young capsules, all with long curved pedicels and elongated necks. They grew in a small dense cushion 1 cm. across, but the label does not say whether on rocks or trees. As neither Limpricht nor Braithwaite cite these specimens, it seems worth noting.

WEISSIA MARITIMA (C. M. & K.).

Ulota maritima C. M. & Kindb.; Macoun, Cat. Can. Pl. 6, 84 (1892).

This species is said to differ from *U. phyllantha* in its short oval capsule with a short neck, shorter and thicker pedicel, curved when moist, the leaves long attenuate to the subulate point, distinctly papillose, the vein narrower, rough on back. The habitat also is on rocks, not on trees. The localities are mostly Western, excepting Miquelon, Delamare, and it is also credited to Sweden, but sterile.

We have examined all of Prof. Macoun's suite of specimens of this and *U. phyllantha* and find fruiting specimens of both in his collection. The finest of *U. maritima* are from Cape Breton, and not listed in his catalogue. There is a decided difference macroscopically between the two species. *U. phyllantha* was collected in fruit by Prof. Macoun at New West Junction, B. C., and the capsules are in better condition than those collected by Howell. These were compared with the Cape Breton specimens, presumably collected on rocks, though the label does not say so. Besides the differences noted above, the latter plants are smaller, darker green or black, not yellow, with stems 5–10 mm. long, leaves 3–4 mm. long, shorter and less circinate when dry, and less papillose on the back of the vein (not more) than *phyllantha*, with the upper cells less distinct and the apex less acuminate. The seta is only 2 mm. long, the neck twisted, not tapering, whereas in *U. phyllantha* the seta is 5 mm. long including the long tapering neck. They are curved in both, perhaps more so in *phyllantha*. The capsules are shorter and more ovoid in *maritima*, but they are mature and full of spores, whereas those of *phyllantha* are old, empty and elongated.

The peristome is reflexed in both, with the cilia erect, but the teeth are longer in *phyllantha*, they are finely granulose and striolate in both, trabeculate at apex in *maritima*, and the cilia are long, carinate, of two rows of cells. The calyptra is brown at apex with long straight hairs.

On the whole, they seem to be distinct enough to separate; if we maintain *crispa* and *crispula* as distinct species, then these are. But the differences in color and size are not constant, for short dark plants have been collected on trees, though we have not seen any tall yellow ones from rocks.

In Jaeger's herbarium there are several specimens from Friesland which resemble *U. maritima* very closely, but they are sterile Those collected in Norway by Lorentz also are small and dark, and grew on rocks.

One of the synonyms given by Braithwaite for *U. phyllantha* may antedate *U. maritima* Kindb. He cites *Gymnostomum viridissimum* Davies, from Wales but without habitat.

WEISSIA ULOPHYLLA Ehrh. Beitr. 1: 191 (1787).

Ulota connectens Kindb.; Macoun, Cat. Can. Pl. 6, 85 (1892).

Ulota camptopoda Kindb.; Macoun, Cat. 75 (1892), fide Macoun.*

It will be noted that the description in the catalogue of *U. connectens* is mainly of the leaves, and all it says of the capsules is

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*In a letter dated January 3, 1894, Professor Macoun states that "Kindberg unites *Ulota camptopoda* and *connectens*, and I believe makes them both *Orthotrichum*."

that they are " dark brown, short, subovoid, not contracted at the mouth, costate, pedicel short, scarcely emergent. Calyptra densely hairy."

Prof. Macoun has sent us all his specimens of this species, and we also have examined his Canadian mosses No. 557.

We are amazed to find that these are simply old plants of what we have been calling *U. crispa*, gathered in the autumn, with the old brown shrivelled capsules buried in the leaves, and pushed aside by the younger innovations, which bear at their summits the young and hairy calyptras of the next generation, just emerging. The capsules including the seta and vaginule measure 4 mm. and have the long tapering neck of this species, the peristome remains in fragments, and the ridges are prominent, of 4–5 rows of brown cells, with the spaces between them contracted and thin. We have compared the leaves also, and they agree. Furthermore we have specimens from various collectors and localities, in precisely this same stage of development, notably those collected on rocks! near Madison, Wisconsin, by Messrs. True and Cheney. (Date not given).

ULOTA CAMPTOPODA Kindb.; Macoun, Cat. 6, 85 (1892) Canadian mosses, No. 582.

We have seen the specimens cited above, and compared them with the description. The capsules are either too old or too young for satisfactory determination, but even on the old capsules we have seen cilia; the description says there are none! The comparisons with *U. maritima* and *U. Ludwigii* after the description are wild ones. It has no specific relation to either! Its alliance is clearly with *U. crispa*, and it is to this species or *U. crispula* that it should be referred, but there are no capsules matured.

WEISSIA MEGALOSPORA (Vent).

Ulota megalospora Vent. Bot. Centr. **44**: 389 (1890) Hedwigia, **32**: 269 (1893).

Dr. Venturi says that this is perhaps one of the most interesting mosses in Roll's collection. It has a cladogenous fruit as in *Ulota Drummondii* and *U. Ludwigii*, but it corresponds to the group of *U. crispa*, and *U. Bruchii* in the crisped leaves; it is remarkable for its large spores, which are warty and reach the dimensions of *Encalypta*, .055–.061 mm., and the leaves end in a single cuspidate cell. The plant grew with other large species of *Orthotrichum* on the bark of trees and very little of it was collected.

Dr. Venturi has generously shared a portion of it with us; unfortunately this portion does not include a capsule, but from the description and leaves we have been able to determine that it is very nearly allied to *U. subulata* and *U. subulifolia* CM. & Kindb. We have not seen specimens of *U. subulata*, but we should not be surprised to find that these three species were one. Unfortunately Kindberg has no idea of the use of measures in descriptions, and never seems to look at the spores, but his description of *U. subulata*, as far as it goes, agrees with *U. megalospora*, which has precedence by two years.

ULOTA SUBULIFOLIA C. M. & Kindb.; Macoun, Cat. 6, 82 (1892).

The description of this species is most unsatisfactory, being only a comparative one, as follows:

"Liffers from *U. subulata* in the stem being more branched, the leaves when dry twisted or subcrisped, sparingly papillose, revolute at the basal margin at least on one side; the basal cells elongate, alar indistinct; capsule very small, short-obovate, costate, finally subcylindric; pedicel not very long; calyptra nearly naked.

On small trees in thickets, Black's Farm, along the Coquilla river, near New Westminster Junction, B. C., April 26, 1889, Macoun."

We have received from Prof. Macoun fine specimens from this locality, numbered 127, which we have examined and measured. The following are our observations:

Plants small, light yellow; stems slender, creeping and tomentose at base, branches erect, 5–7 mm. high; leaves crisped when dry, spreading when moist, from an erect, ventricose base, 1–2 mm. long, narrowly acuminate, carinate with more or less recurved margins, vein thick ending below the cuspidate apex; cells bluntly papillose, upper rounded, .005–.008 mm.; lower longer, narrower, .013–.027 mm., often brown or yellow.

Autoicous, the antheridia in large, brown buds, with broad bracts. Seta long, slender, including the vaginule to tip of lid, 5–7 mm. Capsule small, 1 mm., when ripe ovoid, becoming elongated when empty, with a long tapering neck, which is twisted when dry; lid apiculate, beak long, .216 mm., bordered with yellow; capsules striate, the ridges of 4 rows of cells, yellow and much thickened; teeth united in pairs, reflexed when dry, finely granulose, appearing striolate, smoother and trabeculate at apex, cilia 8, as long as the teeth and smooth; spores brown, warty. .024–.037 mm.

The leaves are very variable in the same plants. The younger ones at the tips of the stems are very long acuminate, the older ones are much broader, sometimes only acute.

We have the same species collected by J. B. Leiberg on *Tsuga Pattoniana*, Traille River Valley, Idaho, received January, 1890, No. 234. Also on *Alnus rubra*, Nooksack River, Whatcom county, Washington, W. N. Suksdorf, July 11, 1890, No. 71.

Club-Root in Common Weeds.

In some instances it has heretofore been somewhat difficult to fully account for the almost perennial presence of Club-root (*Plasmodiophora Brassicæ* Wor.) in various cruciferous crops. Some fields of cabbage and turnip, in particular near New Brunswick, seemed to suggest that some of the cruciferous weeds might harbor the enemy, and with this suspicion in mind, strengthened by the knowledge of the wide range of hosts for the *Plasmodiophora* in the mustard family, Mr. J. A. Kelsey was asked to dig for the slime mould until, if possible, it was found. The lurking pest was not far to seek, and in a short time a hundred roots of the Shepherd's purse (*Bursa Pastoris*), and an equal number of the Hedge-mustard (*Sisymbrium vulgare*) were obtained in the vicinity of the infested cabbage and turnip fields.

Figure 1 shows a group of the *Bursa* roots affected with the *Plasmodiophora*. The roots of this weed are neither large nor fleshy like those of the turnip, and the galls are correspondingly small. Quite frequently the swollen portion is close below the crown, but in some cases the enlargement is midway of the root, and frequently there are smaller galls near the tips of the roots.

In *Sisymbrium* (figure 2) the galls are quite different in outline, being more nearly hemispherical and seemingly situated without any order. There may be three or more of the galls of equal size upon a single root. They are of a darker brown color than in the *Bursa*.

Both kinds of weeds, when badly infested, lose their healthy color, so much so that Mr. Kelsey was able to detect the worst cases of the disease from the dwarfed and sickly appearance of portions of the plant above ground.

Heretofore, so far as the books at hand, Saccardo, Zopf, Woronin, Sorauer, Frank, Eycleshymer, and others, instruct, the hosts which have been definitely recorded are *Brassica oleracea*, with its varieties of cabbage, cauliflower, kale, Brussels sprouts, *Brassica Rapa*, *Raphanus sativus*, *Iberis umbellata* and *Matthiola incana*. It is therefore interesting to add two other genera to the list, and in the manner above intimated, namely, from suspicions that blossomed

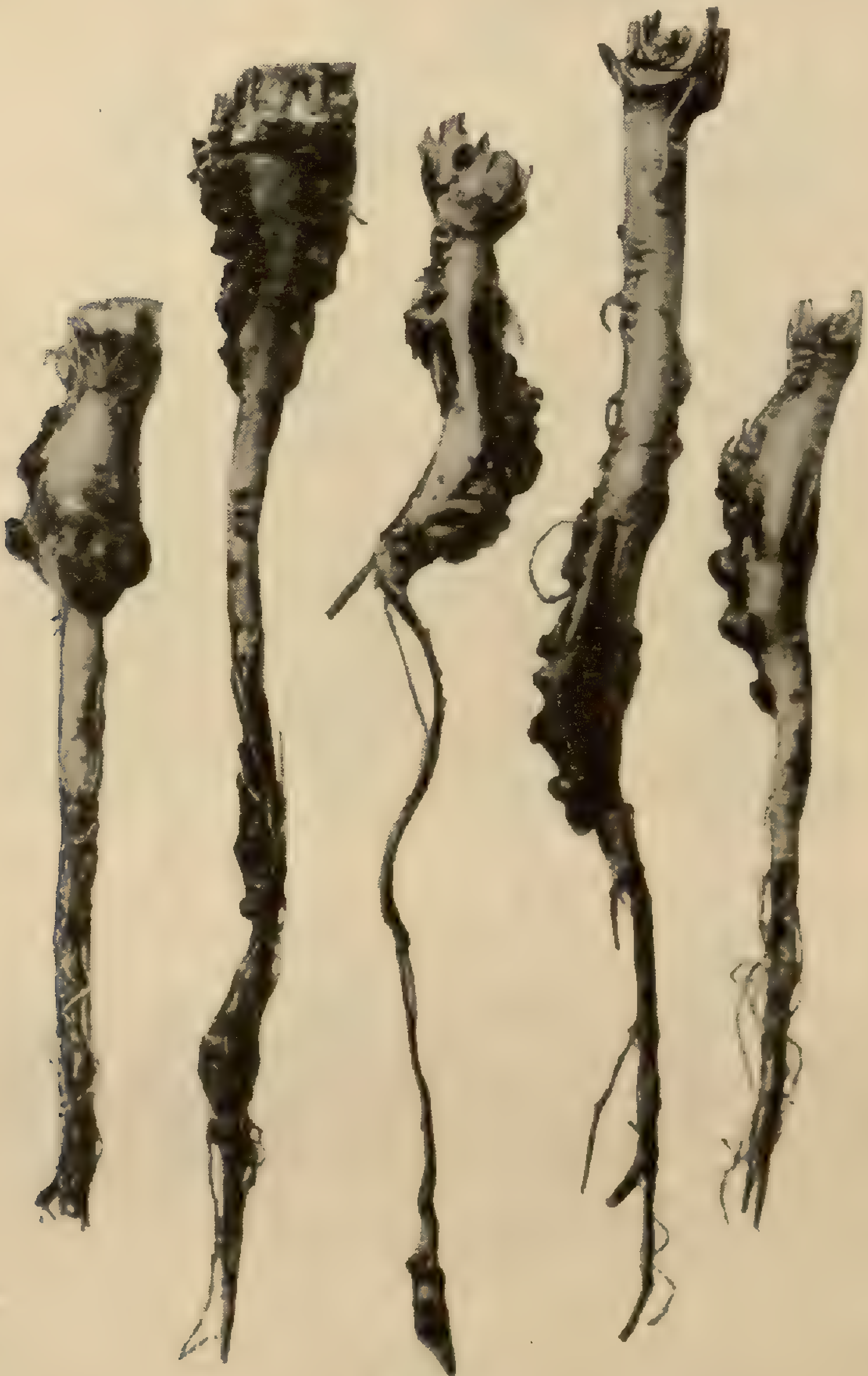

FIG. I.

with circumstantial evidence and reached full fruition in the discovery.

Of course, the strong, practical bearing of this literal unearthing of truth goes without further saying. The fact that these common weeds are the secret hot-beds of this miserable pest is enough to cause the truck growers to raise the hand of destruction against them. It is likely that the number of species of cruciferous weeds bearing the *Plasmodiophora* can be increased as the search is continued.

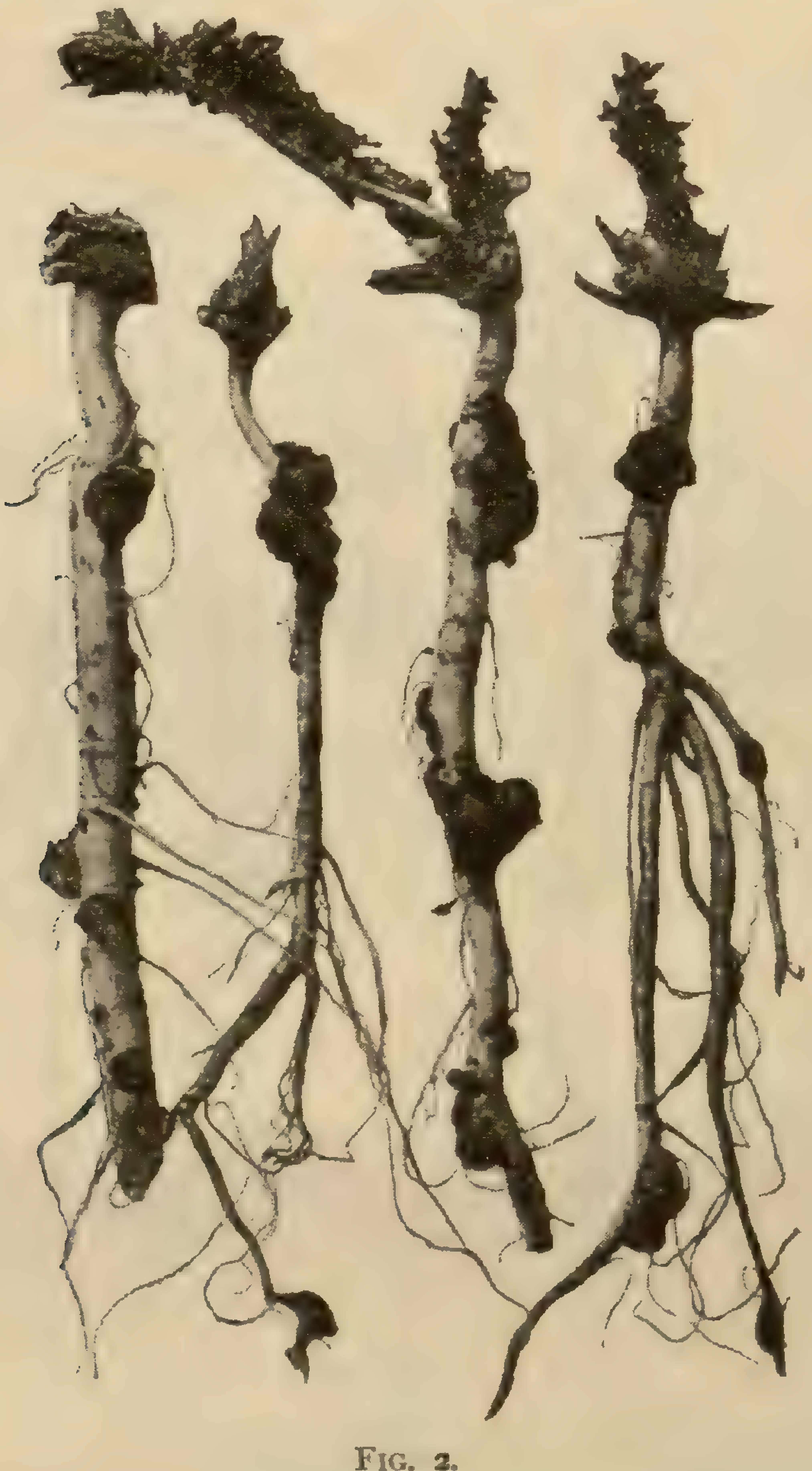

FIG. 2.

BYRON D. HALSTED.

RUTGERS COLLEGE, January 12, 1894.

Potentilla recta L

While visiting in Western New York last summer I came across this plant in Genesee county, about two miles northwest of LeRoy. It was well established along a quiet country road and was quite abundant for a few rods between the roadway and an adjoining wood. It seemed as much at home as *P. Norvegica* and *P. Canadensis*, growing near by. I was told by Mr. E. Huftelen, well-known to florists as a grower of hardy lily-bulbs whose gardens are near by, that he had noticed the plant in this place for about eleven years, and that another locality for it was found a little farther west, near the town of Stafford.

P. recta is in habit more like *P. arguta* than any other Potentilla within its range. But its large flowers with obcordate petals of a pale or sulphur-yellow color, and its symmetrical, digitate leaves, at once indicate something different. The radical and lower stem-leaves are raised on rather long petioles, and nearly all full grown leaves are composed of seven oblanceolate leaflets, whose margins are incisely serrate. The flowers do not last long, the petals being quite fugacious like those of *P. arguta*. But on the whole it is a pretty "weed," and not a bad acquisition to our flora.

Its nearest relative in this country is to be sought in the distant West as *P. gracilis* Dougl., and its varieties. One of these was first described by Nuttall* as *P. recta*(?), who thus doubtfully identified the plant of the Upper Missouri with the European species. This he afterwards changed to *P. rigida*, now *P. gracilis* Dougl. var. *rigida* Watson. *P. gracilis* is a plant of the Rocky Mountain region and of the Pacific slope, extending from New Mexico to the Saskatchewan and Alaska. *P. recta* is indigenous to Middle and Southern Europe, the Caucasus and Western Siberia. It has a place among ornamental plants, but seems to be little cultivated or lightly esteemed, and is not mentioned in such standard works as Nicholson's "Dictionary of Gardening" or Vilmorin-Andrieux's "Fleurs de Pleine Terre." Donne mentions it in the "Hortus Cantabrigensis," and states that it was brought to England from Southern Europe in 1648. This doubtless gives the clue to its introduction into this country, where it has found a place in some old gardens, and has sparsely escaped into the fields. When Torrey and Gray published the first volume of the "Flora of North America" (1838–40), they were unable to ascertain its presence in a wild state in this country. Commenting on the similarity of *P. recta* L., and *P. rigida* Nutt., they remark, "Dr. Short has sent us specimens of *P. recta*, which occurs as a weed in his garden, but we do not learn that it is anywhere naturalized in the United States."* Eaton and Wright, who issued their "North American Botany" about the same time (1840), seem to indicate that it was naturalized, for they mention it, and do not separate it from other native species as an "exotic," as is their custom with cultivated plants of foreign origin, so that we may look upon it as gaining a foothold not far from that time.

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* Genera i. 310.

It is as yet rare and somewhat local, and not of wide range. That usually given is from New England to Northeastern Ohio. It has been most frequently reported from Central and Western New York and the neighboring part of Ontario. Recently (1892) Messrs. Beal and Wheeler have recorded its presence in the southeastern part of Michigan in their "Catalogue of Michigan Plants." It was not given in the previous edition issued in 1881. This is the fathest west where I find mention of it. It is evidently moving westward, and the finding it generally by railroads and roadsides indicates the principal method of advance.

E. J. HILL.

ENGLEWOOD, ILL.

Botanical Notes.

Note on the Herbarium of Stephen Elliott.—It will be of interest to botanists to know that the plants on which Elliott's "Sketch of the Botany of South Carolina and Georgia," published at Charleston, S. C., from 1816 to 1824, is based, are preserved in the museum of the College of Charleston and are readily accessible to students. The collection is unmounted and is tied up in some thirty large volumes. It is in a moderately good state of preservation, some portions of it having, unfortunately, been badly damaged by insect depredations. It contains, besides his own collections in the region covered by his book, many specimens from Schweinitz, Rafinesque, Torrey, Oakes and Muhlenberg, and from his colleagues Drs. Baldwin, Macbride and Mr. Gourdin.

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* l. c., p. 440.

The representation of material from Muhlenberg is probably more extensive than in any other collection in America, and this is a most important circumstance, because Muhlenberg's own herbarium, in charge of the American Philosophical Society at Philadelphia, is in very bad order, imperfectly preserved and not very easily consulted. I found that a very large number of the species of Muhlenberg, first published by Willdenow in his "Species Plantarium" and "Enumeratio," are represented by authentic specimens in the Elliott herbarium. Inasmuch as the only other considerable number of them is to be found in Willdenow's herbarium at Berlin, we have here an easy and in most cases satisfactory method of verifying the original descriptions.

The herbarium is in charge of Dr. G. E. Manigault, to whom I am indebted for much courtesy, and who greatly facilitated my studies.

N. L. Britton.

Heliotropism of Cassia Marilandica.—Several times during my work in Alabama I had opportunity to note the remarkable heliotropism of *Cassia Marilandica.* The plant is very common in what is known as the black prairie soil of the State. The observations were made on plants one to two feet in height which had not yet produced flower buds. At this time the foliage is very luxuriant, and the lower leaves being quite long and the young ones rather crowded on the stem tend to form a loose and broad rosette. During sunny days this rosette always faces the sun and so strong is the heliotropism that the lower leaves are drawn slightly toward the center, making the rosette much more compact. On cloudy days and during the night the plants are normal, but during the day when the sun is out the rosette is formed and turned so that it faces directly toward the sun, following it through the day. Where the plants are numerous they present a very beautiful and striking picture, especially during the morning and evening hours, when the angle of divergence is strongest because of the low position of the sun.

George F. Atkinson.

The Herbarium of the late Dr. C. C. Parry has been purchased by the trustees of the Iowa Agricultural College at Ames, Iowa, as we are informed by Professor L. H. Pammel of that institution. He reports it as containing some 16,000 specimens in excellent condition.

Leucampyx Newberryi A. Gray.—In the Synoptical Flora the genus *Leucampyx* is placed among those genera of the Anthemidæ which have a chaffy receptacle. It is described (in the Key, Vol. 1: Part 2, 78) as having a receptacle "with oblong-lanceolate wholly scarious bracts subtending disk flowers and partly folded round the akenes." This is not an invariable character of the genus, for in specimens of *L. Newberryi* (the only species) received from Dr. T. E. Wilcox and collected near Fort Huachuca, Arizona, the receptacle is in every case quite naked. Dr. Porter writes me that "the chaffs on the receptacle are often few or wanting." T. H. Kearney, Jr.

Reviews and Notes on Literature.

Die Delphinium Arten der Vereinigten Staaten von Nord Amerisa. E. Huth (Helios; reprint, pamphlet, pp. 15; Berlin, 1892).

Dr. Huth was led to study our North American *Delphiniums* through the examination of certain specimens collected by M. Penard in Colorado, and deposited in the Boissier Herbarium at Geneva. He states that he found great insufficiency in the published descriptions of the species, which is quite true, there having been no systematic treatment of the genus by an American author since the Torrey and Gray "Flora of North America" in 1838, Dr. Gray's paper of 1887* being a collection of notes with a key. Dr. Gray recognized the great difficulty of the systematic presentation of the genus, even with the very abundant material in the principal American herbaria at his command, and one notes throughout his paper an unwillingness to reach conclusions; he recognized 20 species and 5 varieties. Dr. Huth, working on the immensely less material contained in the Berlin and Boissier herbaria, only recognizes 8 species, one of which *D. Penardi*, he proposes as new, and 16 varieties, one of the latter, *D. exaltatum Barbeyi*, being also proposed as new,* and all the others based on species proposed by various authors, every one of those characterized by Torrey and Gray, Asa Gray and Sereno Watson being thus reduced. Those retained are *D. bicolor* Nutt., *D. cardinale* Hook., *D. decorum* F. and M., *D. recurvatum* Greene, *D. azureum* Michx., *D. Penardi* Huth, *D. exaltatum* Ait and *D. tricorne* Michx., *D. hesperium* A. Gray, he does not feel sufficiently acquainted with to reduce.

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* Botanical Gazette, 12: 49–54.

N. L. B.

Recherches Experimentales sur la Physiologie, La Morphologie et la Pathologie des Diatomees.—X. Du noyau chez les Diatomees. Miquel, P. (Annales de Micrographie, 5: 437–462, 3 plates. Oct., 1893).

This is an exceedingly interesting contribution to the subject of Diatomology. Mr. Miquel has discussed very fully the subject of the nucleus of the Diatoms, and we feel that much has been added of importance to this branch of the subject. He speaks of the few researches that have been made upon the protoplasmic contents of the diatoms, as most microscopists have busied themselves with the resolving of the finer sculptured forms. The author's researches have been made upon pure cultures of the plants, and he has devised some methods of technique in the study of the nucleus, which may be of interest. The use of methylene blue is recommended as a protoplasmic stain, both general and to differentiate the various parts. The author maintains that the solution should be very weak; indeed just enough of the coloring matter to tinge the fluid in which the plants are growing. This strength is not enough to kill, and the staining takes place gradually, and there is no distortion. By this reagent the various portions of the protoplasm are differentiated. Methylene blue in water; in water and weak boric acid, and in water with weak ammonia are the three solutions used. In carefully stained specimens the protoplasm is just tinged; some of the chromatic elements acquire a darker blue and sometimes even a violet hue, the nucleus being still darker, sometimes being almost black.

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* He has subsequently raised this to specific rank as *D. Barbeyi* (Bull. Herb. Boiss. 1.).

There also some directions for fixing the protoplasm, and the following solution is recommended:

Hydrarg. bi. chlor.	65 gms.
Common salt,	15 gms.
Water to make,	100 c. c.

Specific gravity should be about 1.62.

This solution fixes the protoplasm almost instantaneously, and the coloring methods can then be applied as before. The details of the nucleus are given and figured for *Coscinodiscus concinnus.* In conclusion the author states: "I have said that one could render prominent by the use of methylene blue the chromatine of the nucleus of the diatoms. I recall that this nucleus is always immersed in a special pinnuclear protoplasm, the properties and use of which still remains to be studied; that this protoplasm is always placed in large masses in the centre of the figure of the diatoms; that habitually it forms a bridge, going from one valve to the other; that it is in this protoplasm that one observes the movements of the nucleus, its division or its fragmentation.

S. E. J.

Flore Bryologique du Japon, Nouveux Documents. Emile Bescherelle (Ann. Sci. Nat. (VII.) 17: 327–393, 1893).

The collections enumerated in this paper were made by the Abbé Faurie on the islands of Nippon and Yezo, and some of Savatier's from the vicinity of Yokohama are included. They supplement the enumeration given by Mitten in 1891, and add many new species to the flora. Many of them bore manuscript names given by Schimper, and as far as possible these have been used, but the larger part of the collections, made by M. Faurie, in 1885–1891, are entirely new and from a hitherto unexplored part of Japan. Considering the similarity of the moss-flora of our Western States with that of Japan, it will be well to make some comparisons of the new species, with the new ones so recently published by Kindberg, and the monographers of the Röll collection. There may be some duplication of names, even here.

E. G. B.

Proceedings of the Club.

TUESDAY EVENING, JANUARY 9TH, 1894.

ANNUAL MEETING.

The President in the chair and eighteen persons present.

Annual reports were submitted by both sections of the Committee on Local Flora, and by the Herbarium Committee.

For the former, Section on Phanerogams, Dr. Britton reported that there was a large amount of material in hand available as a foundation for writing a local flora, and enumerated the principal sources and repositories of such information. Several members expressed approval of the report. The Secretary suggested the advisability of making this flora, when written, descriptive in the fullest sense of the term. There seemed to him no good reason for confining descriptions to leaves, flowers and fruits, omitting such parts—less conspicuous, but not less important—as roots, structure of bark, wood, leaves, etc. It would be impossible to begin such work with a flora covering an extensive region, but it might begin with local floras. Dr. Britton replied that several works which had been very successful had been written on a plan tending in this direction. The President remarked upon the desirability of work of this kind.

For the section on Cryptogams Mrs. Britton reported a large amount of excellent work done by members of the committee as individuals, Dr. Jelliffe's work upon the plants in the Brooklyn water supply being specially noted. The great desirability of a check-list of North American mosses, based on the revised code of nomenclature, was pointed out.

Miss Rogers reported that the Curators were unable to properly care for the Club's collections, and did not feel like greatly multiplying them, because of lack of room and conveniences. For the same reason the herbarium bequeathed by the late Miss McCabe had not been unpacked, arranged, or listed. The preparation of a list of desiderata was awaiting the appearance of the new check-list, which should serve as a basis.

Annual reports were submitted by the Treasurer, Recording and Corresponding Secretaries and Editor; the Curator's report being given above for the Herbarium Committee.

The Treasurer, Mr. Ogden, reported all receipts of the Club as amounting to $1,528.45 and disbursements of $1,509.36.

The Recording Secretary, Dr. Rusby, reported upon meetings, attendance, membership and scientific contributions. The attendance has been about the same as in 1892, 412 total and 27 average, the largest 44 and smallest 17. There had been 2 resignations, 3 dropped for non-payment of dues, 3 active, 1 corresponding and 1 honorary member died, with election of 18 active members, yielding a net gain of 1, and making the total membership at present 165. The number of scientific papers presented was 37, nearly double that of the previous year. Considerably more than half of these had been accepted for publication, and had resulted in contributing to science 4 new genera and 107 new species and varieties.

The Editor, Dr. Britton, reported a greater amount of publication effected than during any preceding year, there being 501 pages and 36 full page plates in Vol. 20 of the BULLETIN. Reference was made to the improved method of making up the Index to Recent Literature relating to American Botany which would be adopted in the January number.

The publications in the MEMOIRS were enumerated as follows:

Vol. 3, No. 2. "The Naiadaceæ of North America," by Dr. Thomas Morong, 65 pages and 54 plates.

Vol. 3, No. 3. "Enumeration of the Plants collected in Bolivia by Miguel Bang," by Dr. H. H. Rusby, 67 pages.

Vol. 4, No. 1. "Index Hepaticarum; Bibliography," by Prof. L. M. Underwood, 91 pages.

Vol. 4, No. 2. "The Botanical Exploration of Virginia," by Mr. John K. Small and Miss Anna Murray Vail, is in press, as is also

Vol. 5, No. 1, consisting of the "Check-list of Plants of Northeastern North America," authorized by the Botanists of the American Association for the Advancement of Science.

It was suggested that the size of the BULLETIN should not be further increased with the subscription price remaining at $2, and the Club's membership fee remaining at $4. Any increase in the

Club's funds would be more wisely devoted to extending the MEMOIRS. It was desirable that several back numbers of the BULLETIN be reprinted, so as to allow of preparing a number of full sets of the volumes.

The Club, upon motion of Dr. Rusby, authorized the Editors to reprint the deficient numbers of the BULLETIN in accordance with the suggestion contained in the report.

Under Election of Officers, Dr. Wheelock moved that the Secretary be instructed to cast an affirmative ballot for the reëlection of all the present officers. The motion was seconded and unanimously adopted.

Upon motion by Dr. Britton, the Secretary was requested to place upon the minutes a suitable entry recognizing the character and worth of the late Justus F. Poggenburg, and his connection with and services to the Club and to the cause of Botany, and to communicate a copy of the same to his family.

The regular paper of the evening was then presented by Dr. Britton, entitled "Notes on the Herbarium of Stephen Elliott." An abstract is printed in this number of the BULLETIN.

Index to Recent Literature Relating to American Botany.

Atkinson, George F. Frost freaks of herbaceous Plants. Bot. Gaz. **19**: 40–42. 17 Ja. 1894.

Brief account of frost freaks in *Cunila Mariana* and an unidentified composite.

Craig, Thos. A new *Dictyosphærium*. Proc. Nat. Sci. Assn. S. I. **4**: 10. *Illustrated.* 13 Ja. 1894.

Davis, Chas. A. Botanical Problems. Asa Gray Bull. No. 4. 1894.

DeCandolle, Casimir. Three new Species of Mexican Plants. Bot. Gaz. **19**: 39–40. 17 Ja. 1894.

Guarea Palmeri Rose, *Trichilia Palmer* C. D.C. and *Trichilia Colimana* C. D.C. collected by Edward Palmer.

Eby, Amelia F. Preliminary List of the Lichens of Lancaster County, Pa. Pamphlet, pp. 5. 29 Ja. 1894.

Farlow, W. G. Notes for Mushroom-eaters II., III. Gard. & For. **7**: 43. 31 Ja.; 52. 7 Fb. 1894.

With illustrations of *Agaricus procerus*, *A. campestris* and *A. phalloides*.

Foerste, August F. Botanical Notes from Bainbridge, Georgia. Bot. Gaz. **19**: 33–38. 17 Ja. 1894.

Discusses oaks as weeds; a new compass plant (*Aster concolor*); a rose with green petals; prevalence of fungi; fossil palmettos in Florida.

Fink, B. Blights, Orchids and Ferns. Pamphlet, pp. 12. Fayette, Iowa, Ja. 1894.

Hitchcock, A. S. A hybrid *Baptisia*. Bot. Gaz. **19**: 42. 17 Ja. 1894.

Notes probable hybrid between *B. australis* and *B. leucophæa* in Kansas.

Hooker, J. D. *Erythroxylon Coca*. Curtis' Bot. Mag. **50**: *t. 7334*. Ja. 1894.

Hooker, J. D. *Sobralia xantholeuca*. Curtis' Bot. Mag. **50**: *t. 7332*. Ja. 1894.

A Central American species.

Humphrey, Jas. E. Where Bananas grow. Pop. Sci. Month. **44**: 486–502, *figs. 1–6*. Fb. 1894.

Jenman, G. S. *Asplenium Guildingii* sp. nov. Gard. Chron. **15**: 70. 20 Ja. 1894.

Jenman, G. S. *Trichomanes fruticulosum* sp. nov. Gard. Chron. **15**: 71. 20 Ja. 1894.

Kerr, Walter C. Aerial Roots on *Acer rubrum* L. Proc. Nat. Sci. Assn. S. I. **4**: 11. 13 Ja. 1894.

Kraemer, Henry. The World's Columbian Exposition from a Botanical Standpoint. Amer. Journ. Pharm. Fb. 1894 [reprint, pp. 13].

Langdon, Fanny E. A study of *Epigæa repens*. Asa Gray Bull. No. 4. 1894.

MacDougal, D. T. On the poisonous influence of *Cypripedium spectabile* and *Cypripedium pubescens*. Geol. Nat. Hist. Surv. Minn. Bull. 9, part 1, 32–36, *pl. 3*. 16 Ja. 1894.

MacMillan, Conway. Archenema, Protonema and Metanema. Bot. Gaz. **19**: 19–24. 17 Ja. 1894.

Proposes the term *archenema* for the monomorphic gametophytic structure below the Muscineæ and *metanema* for the secondary stage of the dimorphic gametophytic structure among the Muscineæ.

MacMillan, Conway. On the Occurrence of Sphagnum Atolls in Central Minnesota. Geol. Nat. Hist. Surv. Minn. Bull. 9, part 1, 2–13. 16 Ja. 1894.

Meehan, T. *Trillium grandiflorum*. Meehans' Month. **4**: 17. Fb. 1894.

Munson, T. V. Les Vignes Américaines en Amérique.—I. Rev. Viticulture, 1: 81–84. 13 Ja. 1894.

Oliver, D. *Eremanthus purpurascens* Oliv. Hook. Icon. Plant. 23: *pl. 2282.* Ja. 1894.

A new Brazilian species.

Oliver, D. *Peltanthera floribunda* Benth. Hook. Icon. Plant. 23: *pl. 2298.* Ja. 1894.

A Peruvian species collected by Spruce in 1859.

Oliver, D. *Sipolisia lanuginosa* Glaziou. Hook. Icon. Plant. 23: *pl. 2281.* Ja. 1894.

The description of a new composite genus with one species from Brazil.

Peekholt, Theodor. Brasilianische Nutz-und Heilpflanzen—Musaceen. Pharm. Rundsch. 12: 35. Fb. 1894.

Pieters, A. J. On the Study of Fresh-Water Algæ. Asa. Gray Bull. No. 4. 1894.

Pillsbury, J. H. On the Color Descriptions of Flowers. Bot. Gaz. 19: 15–18. 17 Ja. 1894.

Discusses sources of confusion in determining color in plants. Gives tests of various flowers and foliage as determined by Maxwell discs.

Preinreich, H. *Echinocactus tenuispermus* Link & Otto. Monatssch. Kakteenk. 4: 6. *fig. 20.* Ja. 1894.

Quick, Walter J. Sassafras trees. Science, 22: 6, 1894.

Ecologic and economic notes.

Rothrock, J. T. The American or White Elm. Forest Leaves, 4: 104 Fb. 1894.

Two illustrations of *Ulmus Americana.*

Schneider, Albert. Mutualistic Symbiosis of Algæ and Bacteria, with *Cycas revoluta.* Bot. Gaz. 19: 25–32, *pl. 3–4.* 17 Ja. 1894.

Discusses root tubercles of *Cycas* infested with *Nostoc*, rhizobia and various bacteria.

Schumann, K. *Leuchtenbergia principis* Fish. Hook. Monatssch. Kakteenk. 4: 9, *fig.* 20 Ja. 1894.

Sheldon, E. P. On the Nomenclature of some North American Species of *Astragalus.* Geol. Nat. Hist. Surv. Minn. Bull. 9, part 1, 19–24. 16 Ja. 1894.

Sheldon, E. P. Some Extension of Plant Ranges. Geol. Nat. Hist. Surv. Minn. Bull. 9, part 1, 14–18, *pl. 1–2.* 16 Ja. 1894.

Polygonum rigidulum and *Aster longulus* are described as new.

Smith, John Donnell. Undescribed Plants from Guatemala.—XII. Bot. Gaz. **19**: 1–14, *pl. 1, 2.* 17 Ja. 1894.

Twenty-six species characterized; sixteen belonging to Meliaceæ and Piperaceæ by C. De Candolle. *Ardisia paschalis* n. sp. and *Pinus Donnell-Smithii* Mast. are figured.

Stevens, Thomas S. Late-Blooming Trees. Science, **22**: 12 Ja. 1894.

Thompson, F. J. Late-Blooming Trees. Science, **22**: 11. Ja. 1894.

Tilden, Josephine E. List of Fresh-water Algæ collected in Minnesota during 1893. Geol. Nat. Hist. Surv. Minn. Bull. 9, part 1, 25–31. 16 Ja. 1894.

Tourney, I. W. The gradual Disappearance of the Range Grasses of the West. Science, **22**: 9. Ja. 1894.

Contributions from the Herbarium of Columbia College.

[The numbers omitted from this list are out of print.]

No. 4. A List of Plants Collected by Miss Mary B. Croft at San Diego, Texas. By N. L. Britton and H. H. Rusby (1887), ... 25 cents.

No. 5. New or Noteworthy North American Phanerogams. By N. L. Britton (1888), ... 25 cents.

No. 6. An Enumeration of the Plants Collected by Dr. H. H. Rusby in South America, 1886–1887. By N. L. Britton. (Twenty-three parts published; not yet completed.)

No. 7. The Genus *Hicoria* of Rafinesque. By N. L. Britton (1888), . . 25 cents.

No. 8. A Recent Discovery of Hybrid Oaks on Staten Island. By Arthur Hollick. (1888), ... 25 cents.

No. 9. A List of Plants Collected by Dr. E. A. Mearns at Fort Verde and in the Mogollon and San Francisco Mountains, Arizona, 1884–1888. By N. L Britton.

The General Floral Characters of the San Francisco and Mogollon Mountains and the Adjacent Region. By H. H. Rusby (1888), ... 25 cents.

No. 11. Preliminary Notes on the North American Species of the Genus *Tissa*, Adans. By N. L. Britton (1889), ... 25 cents.

No. 12. The Genus *Eleocharis* in North America. By N. L. Britton (1889), 25 cents.

No. 13. New or Noteworthy North American Phanerogams, II. By N. L. Britton 1889), ... 25 cents.

No. 14. A List of State and Local Floras of the United States and British America. By N. L. Britton (1890), ... $1.

No. 15. A Descriptive List of Species of the Genus *Heuchera*. By Wm. E. Wheelock (1890), ... 25 cents.

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No. 21. Notes on the North American Species of Eriocauleæ. By Thos. Morong (1891), ... 25 cents.

No. 22. New or Noteworthy North American Phanerogams, V. By N. L. Britton (1891), ... 25 cents.

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No. 3.—An Enumeration of the Plants Collected in Bolivia by Miguel Bang. By H. H. Rusby. Price, 50 cents.

Vol. IV. No. 1.—Index Hepaticarum Part 1, Bibliography. By Lucien M. Underwood. Price, 75 cents.

No. 2, in press, contains a paper on the Botanical Exploration of Virginia by John K. Small and Anna Murray Vail.

Vol. V., No. 1, also in press, contains the official list of Northeastern American Plants of the Botanical Club, American Association for the Advancement of Science.

(*3*) The Preliminary Catalogue of Anthophyta and Pteridophyta reported as growing within one hundred miles of New York, 1888. Price, $1.00.

VOL. 21. MARCH, 1894. No. 3.

BULLETIN

OF THE

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CONTENTS:

PAGE.
A Study of the Genus *Psoralea* in America: *Anna Murray Vail* 91
Notes on certain Plants of our Eastern Flora: *Thos. C. Porter* 120
An Examination of the Pubescence of the Styles and Filaments of *Lonicera hirsuta*, *L. Sullivantii* and *L. dioica*: (PLATES 181 AND 182): *A. A. Tyler* 123
Germination of the Spores of *Cerebella Paspali* (PLATE 183): *Geo. F. Atkinson* . . 127
Shrinkage of Leaves in Drying (PLATE 184): *Byron D. Halsted*: 129
Morphological Notes on the Genus *Brunnichia* (Illustrated): *John K. Small* . . 131
PROCEEDINGS OF THE CLUB 132
INDEX TO RECENT LITERATURE RELATING TO AMERICAN BOTANY 134

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The Club meets regularly at Columbia College, 49th Street and Madison Avenue, New York City, on the second Tuesday and last Wednesday of each month, except July, August and September, at 8 o'clock, P. M. Botanists are cordially invited to attend.

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BULLETIN
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A Study of the Genus Psoralea in America.

By Anna Murray Vail.

The genus *Psoralea* was first established by Linnæus in the second edition of the Gen. Plant., 358 (1742) and credited to Royen.

In the first edition of the Sp. Plant., 762 (1753), eight species are described, only one of which is credited to America, and is probably an introduced plant from the Island of Madeira.*

DeCandolle in Prodr. 2: 218 credits fifteen species to the United States, Canada and Mexico, some of which, however, have been reduced.

Bentham and Hooker in Gen. Plant. 1: 491, give thirty species to North America and six to South America.

In his Rev. Gen. Pl., p. 193, O. Kuntze transfers all the species of *Psoralea* to the Genus *Lotodes*, Siegesbeck, Fl. Petrop. 66 (1736).

An attempt has been made in this study to base the classification as much as possible on the fruit characters, which are very marked. The genus is accepted as described by Bentham and Hooker.

§ 1. Leaves palmately 3–5-foliolate (rarely 7-foliolate).
  Herbs, erect or assurgent, branching (except *P. cyphocalyx*).
    Flowers small (5–8 mm.).
      Pods globose.
        Leaflets linear-oblong, pods glabrous. *1. P. lanceolata.*
        Leaflets filiform-linear except the basal ones, pods glabrous. *2. P. micrantha.*
        Leaflets obovate, cuneate-obovate or lanceolate-oblong, pods villous. *3. P. Purshii.*

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* Psoralea Americana.

Pods lunate, transversely wrinkled and roughened; leaflets filiform-linear. *4. P. Lupinellus.*

Pods ovate-oblong, wrinkled; leaflets and spikes sessile or nearly so. *5. P. bracteata.*

Pods ovoid or ovate.

Pods with an abrupt short beak.

Leaflets small, flowers few, loosely scattered on slender elongated racemes. *6. P. tenuiflora.*

Leaflets oblong-obovate, flowers several together in interrupted spikes or racemes. *7. P. obtusiloba*

Leaflets oblong, flowers many in crowded elongated spikes or racemes. *8. P. floribunda.*

Pods with a slender elongated beak.

Leaflets linear, flowers slender-pedicelled in loose elongated racemes. *9. P. linearifolia.*

Leaflets linear-lanceolate, plant silvery canescent; calyx inflated in fruit. *10. P. digitata.*

Leaflets oblong, plant silvery or woolly-canescent throughout; calyx not inflated in fruit. *11. P. argophylla.*

Flowers large (1–2 cm.).

Calyx gibbous on the upper side.

Bracts broadly ovate (or in *P. canescens* often lanceolate-ovate).

Bracts as long as the calyx and enclosing it. *12. P. Reverchoni.*

Bracts barely longer than the pedicel; leaflets lanceolate-linear. *13. P. cyphocalyx.*

Bracts as long as or somewhat shorter than the pedicel; leaflets obovate, sparingly canescent or glabrous. *14. P. canescens.*

Bracts lanceolate-ovate, attenuate, as long as the calyx lobes; leaflets oblong. *15. P. cuspidata.*

Plants low, spreading, acaulescent or apparently so.

Flowers small (5 mm.).

Leaflets small, pod globose, with a long attenuate beak. *16. P. pentaphylla.*

Flowers large (1–2 cm.) and roots fusiform tuberous.

Hirsute with weak spreading or appressed white hairs.

Leaflets oblong-cuneate. *17. P. esculenta.*

Leaflets linear-oblong. *18. P. hypogæa.*

Stems hirsute; leaflets glabrous, except the ciliate margins. *19. P. subacaulis.*

Hirsute with more or less rigid, appressed or spreading pubescence.

Bracts large, scarious, deciduous, as long as the calyx. *20. P. Californica.*

Bracts much smaller than the calyx, the lower lobe of which is broadly ovate or spatulate. *21. P. castorea.*

1. PSORALEA LANCEOLATA Pursh.

Psoralea lanceolata Pursh, Fl. Am. Sept. 475 (1814). Type in Herb. Acad. Phila.

Psoralea elliptica Pursh, Fl. Am. Sept. 741 (1814). Type in Herb Acad. Phila.

Psoralea arenaria Nutt. Gen. **2**: 103 (1818).

Psoralea laxiflora Nutt.; Torr. and Gray, Fl. N. Am. **1**: 299 (1838).

Psoralea scabra Nutt.; Torr. and Gray, Fl. N. Am. **1**: 300 (1838).

Erect or assurgent, 15–40 cm. or more high, aromatic glandular throughout; stems glabrous or with a minute pubescence and often a few scattered scarious scales at the base; stipules 3–12 mm. long, linear-lanceolate or setaceous; petioles 1–2 cm. long; leaves 3-foliolate; leaflets 1½–4 cm. long, linear-lanceolate or the basal ones obovate, acute or obtuse, mucronate, glabrous or with a few hairs; peduncles longer than the leaves, (2½–5 cm.); inflorescence capitate, small; bracts minute; flowers nearly white; calyx minutely hairy; lobes nearly equal, obtuse; pod globose, 5 mm. long, light with conspicuous large raised brown glands, nearly glabrous; beak small and erect; seed globose, brown.

In O. Kuntze Rev. Gen. Pl. 193, *P. ellipticum* under *Lotodes* is claimed to be on p. 471, of Pursh, Fl. Am. Sept., and therefore preceding the description of *P. lanceolata*, whereas in reality the description of Bradbury's plant under that name occurs in the supplement on p. 741.

Saskatchewan—Macoun, No. 110 (1879).

North West Terr.—Nicollet; River that Turns, Macoun (1879).

Montana—L. F. Ward (1883); Coues; Yellowstone Park, Chas. H. Hall (1888); above Glendive, L. F. Ward.

Idaho—Camass Creek, W. H. Forwood, No. 41 (1880).

Oregon—Kellogg and Harford, No. 167 (1868–9); E. Hall, No. 105 (1871); Lyall (1860); Geyer, No. 653.

Dakota—Stevens. Pac. R. R. Exp.

Nebraska—Valentine, J. M. Bates, No. 10; Keith Co., G. D. Swezey; Fort Kearney, Fendler (1849); Fort Pierre, Hayden (1853–4).

Iowa—Sioux City, A. S. Hitchcock (1888).

Kansas—Manhattan, Kellerman (1890).

Missouri—Lewis and Clarke (type of *P. lanceolata*); "Upper Louisiana" from Herb. Bradbury, in Herb. Camb. (type of *P. ellipticum*); Nicollet (1839); Buckley (1853).

Colorado—Palmer; Colorado Springs, M. E. Jones, No. 142 (1878); Wolf and Rothrock, No. 181 (1873); Fritchy, No. 8 (1886).

Arizona—Plains near Chirricalma, Lemmon (1881).

2. PSORALEA MICRANTHA A. Gray.

Psoralea micrantha A. Gray; Torr. Pac. R. R. Rep. 4: 77 (1856). Type in Herb. Columbia College.

Assurgent, 3 dm. or more high, from a horizontal root or long slender rootstock of often 1 m. or more in length; stems glabrous, with scattered brown glands, and often broadly-lanceolate or ovate scales at the base; stipules setaceous, varying in length; leaves 3-foliolate, crowded; leaflets linear or filiform-linear, 1–5 cm. long, the basal ones oblong or cuneate-oblong; peduncles about the length of the leaves; flowers white or bluish in small heads or loosely scattered in short spikes; bracts minute; calyx somewhat hirsute, glandular, the lobes about equal; pod globose, over 5 mm. long, glabrous, light brownish with raised darker glands and a straight, slender beak; seed 5 mm. long, globose, somewhat flattened when dry, brown, smooth and shining.

Nebraska—Chimney Rock, H. Engelmann (1858); Fort Kearney, H. Engelmann (1858); Banner Co., Rydberg (1890); Kearney Co., Rydberg, No. 53 (1891).

Kansas—Manhattan, Kellerman.

Indian Terr.—Last Camp on the Canadian, Bigelow (1853), type.

Oklahoma Terr.—Guthrie, Carleton, No. 151 (1891).

Arizona—Rusby (1883); Plains East of the San Francisco Mts., Lemmon (1884); East of Mt. Agassiz, Lemmon.

3. PSORALEA PURSHII, n. sp.

Lotodes ellipticum latifolium Kuntze, Rev. Gen. Pl. i. 193 (1891), not *P. latifolia* Torr. Type Empire City, M. E. Jones, No. 3825 (1882).

Assurgent, glandular throughout, 1–6 dm. or more high from a long slender rootstock, stems glabrous or often somewhat hirsute at the base, scales ovate, scarious; stipules 5 cm. or more long, lanceolate; leaves 3-foliolate, 1½–4 cm. long, obovate, cuneate or elliptical, or the uppermost nearly lanceolate and often much narrower, varying greatly in size and shape, retuse or mucronulate, glandular, glabrous or with a few scattered white hairs; peduncles varying in length, rarely longer than the leaves; flowers scattered in slender spikes or crowded in nearly capitate heads; bracts minute; calyx-lobes about equal, sparingly hirsute; pod globose, over 5 mm. long, with a short erect beak, light with scattered brown glands, and more or less densely villous with silky white hairs; seed globose, 5 mm. long, light brown.

Washington—On a sand hill near the Columbia River, Suksdorf, No. 963 (1890); near Columbus, Suksdorf, No. 851 (1886).

Nevada—Grass Valley, Watson, No. 250 (1868); Empire City, M. E. Jones, No. 3825.

Idaho—Nez Percé Co., Sandberg.

The specimens here cited have passed as *P. lanceolata* as well as several that are put under *P. micrantha*. The type of *P. lanceolata* is an intermediate form from the plains of Missouri, and there is no fruit description. The broad leaved form, *P. Purshii*, has a conspicously villous pod, and it will be interesting to note whether that character remains constant in future collections. The extremes are so marked that it is deemed advisable to keep them separate, though it will be difficult to distinguish them without the fruit.

4. PSORALEA LUPINELLUS Michx.

Psoralea Lupinellus Michx. Flor. Bor. Am. **2**: 58 (1803). Type in Herb. Michx., fide Torrey and Gray.

Psoralea Floridana Shuttleworth in Distrib. Pl. Rugel (1843), name only.

Erect, 3–6 dm. high, slender, branching, glabrous, somewhat glandular; stipules 2–5 mm. long, setaceous; petioles mostly shorter than the leaflets; leaves 5–7-foliolate; leaflets 5–8 cm. long, filiform-linear, with a few scattered glands, the lower ones rarely narrowly oblong-cuneate; peduncles longer than the leaves; racemes slender; flowers few, scattered; bracts minute, ovate, cuspidate; calyx sparingly pubescent, the lobes short, nearly equal; pod 1 cm. long, glandular, somewhat lunate, obliquely twisted, transversely wrinkled, with a short curved beak; seed ovoid, brown.

North Carolina—"Fields of Carolina," Pursh; Cumberland Co., Curtiss (1845).

Georgia—Baldwin; Boykin; Dr. Grant; Niesler; Lewis Leconte; Savannah, Mrs. Say.

Florida—Nuttall; Buckley; between Tallahassee and St. Mark's, Rugel (1843); South Florida, Rugel, No. 163 (1845); Chapman, No. 44 in Herb. Torrey; Tampa, Garber, No. 34; Curtiss (1875); near Jacksonville, Curtiss, N. Am. Pl., No. 558; East Florida, Mary Reynolds.

5. PSORALEA BRACTEATA L.

Psoralea bracteata L. Mant. 264 (1771), fide M. K. Curran, Bull. Calif. Acad. **1**: 135 (1885).

Psoralea fruticosa Kellogg, Proc. Calif. Acad. Sci. 7: 91 (1876).

A low spreading sub-shrub, more or less canescent-pubescent throughout; stipules nearly 1 cm. long, lanceolate-subulate; leaves 3-foliolate, sessile or very short-pedicelled (becoming elongated when old), crowded; leaflets 1–2½ cm. long, oblong-obovate, cuneate, mucronate with a recurved rigid spine, very glandular; spikes sessile at the ends of the branches, the lower flowers in the axils of the leaves; bracts lanceolate or ovate, acuminate, nearly as long as the flowers; calyx-lobes ovate, acute, glandular, the lower lobe the longest; "pod glabrous, ovate-oblong, acute, wrinkled and roughened."

California—Streams of Mt. Tamalpais, F. P. McLein (1873). Apparently not since collected. I have not seen mature fruit of this species.

6. PSORALEA TENUIFLORA Pursh.

Psoralea tenuiflora Pursh, Fl. Am. Sept. 475 (1814). Type in Herb. Acad. Phila.

Erect, 2–6 dm. or more high, often from a long subterranean root, stems branching, glabrous or minutely canescent, especially above, glands black, scattered; petioles mostly shorter than the leaflets; leaves 3-foliolate, the basal ones rarely 4–5 foliolate; stipules minute, setaceous; leaflets 5 mm.–4 cm. long, 3–8 mm. wide, oblong elliptical, obtuse or mucronulate, glandular on both surfaces, glabrous above, sparingly canescent beneath; peduncles 2–8 cm. long; bracts minute, ovate, acuminate; flowers 1–3 together, scattered on slender racemes, calyx very small, with a few hairs, closely covered with dark reddish or brown glands, the lobes acute; pod 8 mm. long, ovoid, glabrous, covered with reddish or brown glands; beak short, stout, somewhat recurved; seed 5 mm. long, ovoid, brown.

Differing from *P. floribunda* in its more slender habit, smaller leaves, smaller, fewer and more scattered flowers and generally more glabrous and glandular appearance. Possibly the two species may run together, though in the bulk of the material in the herbaria examined they can be easily separated. Mr. P. A. Rydberg, who has studied the species in the field, considers them undoubtedly distinct, and it seems advisable to keep them apart.

Montana—Fort Custer, Mearns, No. 244 (1889).

Wyoming—North Fork of the Platte, Frémont (1842); Turkey Creek, Frémont (1845).

Illinois—Beardstown, Geyer (1842).

Missouri—Big Bend of the Missouri, Lewis and Clarke (Sept. 21, 1804, type); Herb. Chapman.

Arkansas ?—Vernijo, Abert (1840).

Nebraska—Fort Kearney, Engelmann (1856); Drexel Co., P. A. Rydberg (1890); near Sidney, P. A. Rydberg, No. 47 (1891).

Kansas—Sherman Co., Smyth, No. 345 (1892).

Colorado—G. W. Hulse; Golden, Britton (1882); Boulder, E. Penard, No. 176 (1891).

7. PSORALEA OBTUSILOBA Torr. and Gray.

Psoralea obtusiloba Torr. and Gray, Fl. N. Am. 1: 300 (1838). Type in Herb. Columbia College.

Psoralea tenuiflora var. *obtusiloba* S. Wats. Bibliogr. Ind. 255 (1878).

Erect, 30–60 cm. high, branches spreading, stems more or less canescent with fine, appressed, silky, white hairs; stipules very small, setaceous; petioles much shorter than the leaflets, the upper ones often nearly sessile; leaves 3-foliolate, the basal ones often 4–5-foliolate; leaflets 5 mm. to 3 cm. long, 3–12 mm. or more wide, oblong-obovate, retuse or mucronulate, covered on both surfaces with minute black glands, glabrous above, minutely canescent beneath; racemes 3–9 cm. long; flowers loosely scattered; bracts very small, ovate, cuspidate; calyx canescent with white, silky hairs, the lobes glandular, obtuse or acutish; pod about 8 mm. long; beak short, stout, straight; seed compressed, obliquely ovoid, brown.

Intermediate between *P. tenuiflora* and *P. floribunda*. Differing from the latter in its less dense inflorescence and much broader leaflets and somewhat larger flowers and less pubescent or canescent appearance.

Texas—Drummond (II.) No. 123; (type); Lindheimer, No. 36 (1843); El Paso, Vasey (1881); on the Upper Colorado (1854), collector unknown.

New Mexico—Wright, No. 969?; Cobra Spring, W. B. Pearce (1878).

Arizona—Bear Mts., Rusby, No. 78 (1880); Oak Creek, Rusby (1883); Willow Springs, Palmer, No. 512 (1890); Oracle Camp, Sta. Catalina Mts., Lemmon (1881); Flagstaff, M. E. Jones, No. 3952 (1884); Flagstaff, Tracy and Evans, No. 276 (1887); Mexican Boundary Survey, No. 218; Fort Whipple, Coues and Palmer, No. 83 (1865); Fort Apache, Mrs. R. W. Hoyt (1893).

Mexico—Berlandier, No. 1749 (1828); Cañon of Guadaloupe, Capt. E. K. Smith; Los Nogalos, Sonora, Capt. Smith.

8. PSORALEA FLORIBUNDA Nuttall.

Psoralea floribunda Nutt.; Torrey and Gray, Flora N. Am. 1: 300 (1838). Types (Nuttall) in Herb. Columbia College and (Pitcher) in Herb. Acad. Phila.

Erect 3 dm. to over 1 m. high, profusely branching, canescent, not glandular: petioles 5 mm. to 3 cm. long, mostly shorter than the leaflets; stipules 3–7 mm. long, subulate, sometimes reflexed; leaves 3–5 sometimes 7-foliolate; leaflets 1–3½ cm. or more long, 3–8 mm. wide, oblong, glandular on both surfaces, glabrous, rugose, with a few scattered hairs above, canescent with closely appressed white hairs beneath; peduncles 6–14 cm. long; spikes oblong or cylindrical, densely many flowered, the flowers at length interrupted and appearing almost as if whorled; bracts 2–3 mm. long, lanceolate, hirsute; calyx canescent, the lobes triangular, acute, the lower one the longest; pod ovoid, glabrous, light brown, covered with darker glands, beak short, stout, straight; seed 5 mm. long, compressed.

Montana—Belt Mts., Scribner, No. 25.

Wyoming—Laramie River, R. B. Hetz (1864).

Nebraska—Hayden (1853); Fort Pierre, Hayden (1853); Lancaster Co., Webber (1874).

Illinois—Pekin, Buckley; Carlisle, Buckley (1838); Augusta, S. B. Mead (1844), a specimen in Herb. Torrey with very long leaves and more slender inflorescence; Athens, Elihu Hall; H. H. Babcock.

Kansas—Miami Co., J. H. Oyster, No. 2146 (1883); Topeka, B. B. Smyth, Nos. 315 and 345 *b.* (1888 and 1890); Fort Riley, E. E. Gayle, No. 487 (1892); Hiawatha, A. S. Hitchcock.

Missouri—Cass Co., G. E. Broadhead (1863); Upper Missouri, Beck; Franklin, Th. Meehan (1871); Courtney, B. F. Bush (1891).

Colorado—Platte River, Coulter (1873).

Mississippi—N. Riehl (1846).

Maryland—Jackson Co. (1864), collector unknown.

Arkansas—Nuttall (type); Pitcher; Abert (1840); Leavenworth; between Illinois River and Neosho River, Engelman, No. 1059 (1835).

Indian Terr.—Between Fort Cobb and Fort Arbuckle, Palmer, No. 103 (1868).

Texas—Lindheimer, Nos. 157 and 373; Reverchon in Curtiss N. Am. Pl. No. 566; Wright.

New Mexico—Wright Nos. 968 and 969; Council Grove, Wislizenus, No. 415 (1846).

Arizona—Sta. Rita Mts., Pringle, No. 282 (1881).

Mexico—Berlandier, No. 1749.

9. PSORALEA LINEARIFOLIA Torr. and Gray.

Psoralea linearifolia Torr. and Gray, Fl. N. Am. 1: 300 (1838). Type in Herb. Gray.

Erect, 3–6 dm. high, widely branching; stems not always glandular, glabrous or sparingly pubescent with appressed hairs; stipules 3–7 mm. long, lanceolate or setaceous; leaves sessile or short-petioled, 1–3-foliolate; leaflets 2–6 cm. or more long, 2–3 mm. wide, linear, rugose, glandular, glabrous or with a few appressed hairs; peduncles 8–18 cm. long; flowers blue, loosely scattered, 1–4 together on slender pedicels 4–8 mm. long; bracts 2 mm. long, ovate, acuminate; mature calyx campanulate, 4 mm. long, glandular, slightly pubescent, the lobes nearly equal; pod 8 mm. long, ovoid or oblong, glandular, with a short, stout, straightish beak; seed flat, oblique, dark brown.

Nebraska—Kearney, Mrs. A. A. Austin; Cañon near North Fork of the Platte River, Rydberg (1890).

Indian Terr.—Between Fort Cobb and Fort Arbuckle, Palmer, No. 102 (1868.) Comanche Plains on the Upper Canadian, Bigelow (1853).

Texas—Near Dallas, Reverchon; Reverchon in Curtiss, N. Am. Pl. No. 263 *a*; E. Hall, No. 126 (1872); near Fort Concho, V. Havard (1881).

Arkansas—Beyrich (type 1834).

PSORALEA LINEARIFOLIA ROBUSTA Coulter, Contr. U. S. Nat. Herb. No. **2**: 34 (1890). A broader-leaved more robust form of the type.

Texas—Clarendon, Donley Co., Neally (1888.)

10. PSORALEA DIGITATA Nuttall.

Psoralea digitata Nutt.; Torr. and Gray Fl. N. Am. 1: 300 (1838). Type in Herb. Columbia College.

Psoralea campestris Nutt.; Torr. and Gray Fl. N. Am. 1: 301 (1838). Type in Herb. Columbia College.

Erect, branching, 3–6 dm. or more high, appressed canescent-hirsute throughout; stipules 5mm.–1 cm. long, lanceolate, sometimes reflexed; leaves mostly 5-foliolate (the upper ones sometimes 3-foliolate); pedicels rarely longer than the leaflets; leaflets 2–3½ cm. long, the largest 5 mm. wide on petioles 3–6 cm. long, rough, with a few dark glands and the midvein pubescent above, densely pubescent with white appressed hairs beneath; peduncles 18–20 cm. long; flowers in interrupted spikes; bracts obcordate, 5 mm. long, nearly as broad, sparingly glandular; calyx much enlarged in fruit, the lower lobe the longest; pod entirely enclosed in the calyx, hirsute, beak slender, straight; seed ovoid, grey, nearly 5 mm. long.

Dakota—Black Hills, W. H. Forwood.

Nebraska—Platte Plains, Nuttall (type of *P. campestris*); Upper Platte, Hayden (1853); Rydberg, No. 51 (1891).

Kansas—T. H. Oyster, No. 2125 (1887).

Arkansas—Red River, Nuttall (type); Beyrich (1834), Leavenworth.

Indian Terr.—Canadian River, Gordon, No. 11 (1848); between Fort Cobb and Fort Arbuckle, Palmer, No. 101 (1868); Canadian River, Bigelow (1853–4).

Texas.—Capt. Pope; Dallas, Reverchon in Curtiss N. Am. Pl. No. 553*; Dallas, Elihu Hall, No. 123 (1872).

Oklahoma Terr.—Kingfisher, M. A. Carleton, No. 184 (1891).

11. PSORALEA ARGOPHYLLA Pursh.

Psoralea argophylla Pursh, Fl. Am. Sept., 475 (1814). Type in Herb. Acad. Phila.

Psoralea incana Nutt. Fras. Cat. (1813), name only. Type in Herb. Acad. Phila.

Psoralea argophylla var. *decumbens*, A. Gray, Pac. R. R. Rep. **12** : 41 (1860).

Roots thickened, rhizome often 30 cm. or more long, stems erect, 3–5 dm. or more high, branching, silvery canescent throughout; stipules ½–1 cm. or more long; petioles as long or somewhat longer than the leaflets; leaves 5-foliolate; leaflets 1½–4 cm. long, 6 mm. –2 cm. broad, oblong, or oblong-cuneate, obtuse or sometimes mucronulate, more or less canescent with silky white hairs on both surfaces, with a few scattered small black glands; peduncles much longer than the leaves; flowers two or three together in an interrupted raceme or spike; bracts ovate-lanceolate, acute 5–8 mm. long; calyx-lobes acuminate, the lower one over 1 cm. long and longer than the ovate straight beaked pod; seed flat, 4 mm. long, brownish.

North West Terr.—Moose Mt., Macoun (1880); Souris Plain (Assiniboia), Macoun (1887); Saskatchawan, Bourgeau (1857–8); Saskatchawan Plains, Macoun, No. 416; St. Peter's, Parry; Nicollet.

Montana—Elliott Coues (1874); Stendive, L. F. Ward (1883).

Dakota—Black Hills, W. H. Forwood; Glatfelter.

Minnesota—Dr. Sykes (1849); Upper Missouri River, Parry (1848); St. Anthony Falls, Torrey; Falls of St. Anthony, Dr. Houghton, No. 63; St. Anthony, T. J. Hale (1861); St. Peter's River Hall (1861); Fort Snelling, Hall (1861); Minnehaha, H. H. Babcock (1872); Winnebago City, H. W. Babcock (1871); Minneapolis, Sandberg, No. 278 (1891); Hennepin Co., Sandberg (1890); Fort Snelling, Mearns, No. 244 (1890).

Wisconsin—St. Croix, T. J. Hale (1861).

Iowa—C. C. Parry (1847); A. Commons; Emmet Co., R. J. Cratty; Ames, A. S. Hitchcock.

Nebraska—F. V. Hayden (1853); Fort Kearney, H. Engelmann (1858–9); Big Nemahah River to Fort Kearney, Fendler (1849); Ogalalla, Earle (1880); Fort Niobrara, Fisher (1889);

Wilcox (1888); Saunders Co., Rydberg (1889); Kearney, Jesse H. Holmes (1889); Valentine, J. M. Bates (1889); G. D. Swezey, No. 22.

Utah—Capt. Bishop (1872).

Kansas—Fort Riley, Gayle, No. 546; (1892); Good Land, Smyth, No. 337 (1892); Manhattan, Phoebe Haines.

Missouri—Pursh (type); Nuttall; Little Muddy River, Buckley; Th. A. Culbertson (1850); Franklin, Th. Meehan (1871).

New Mexico—Fendler, No. 123 (1847); Cimarron River, Fendler, No. 137 (1847); also Fremont's 3d Expedition, No. 15 (1845).

12. PSORALEA REVERCHONI S. Wats.

Psoralea Reverchoni S. Wats. Proc. Am. Acad. **21**: 447 (1886).

Erect, branching, 6 dm. or more high, pubescent, the upper portion hirsute with appressed white hairs; stipules subulate, nearly equalling the petioles; petioles shorter than the leaflets, leaves 3–5-foliolate; leaflets 1½–3½ cm. long, linear-oblong, acute at each end; flowers few in short, close spikes; bracts 1½ cm. long, broadly ovate, cuspidate with a cordate base, pubescent and covered with brown glands; calyx 1–1½ cm. long, gibbous, glandular, hirsute, ciliate with white hairs, the lobes lanceolate, the lower one the longest. Fruit not seen.

Texas—Johnson Co., Reverchon, Curtiss N. Am. Pl. 553 **; Hood Co., Reverchon (type).

Indian Terr.—Between Fort Cobb and Fort Arbuckle, Palmer, No. 72 (1868).

13. PSORALEA CYPHOCALYX A. Gray.

Psoralea cyphocalyx A. Gray, Bost. Journ. Nat. Hist. **6**: 172 (1850). Type in Herb. Gray.

Psoralea palmata Buckley, Proc. Phila. Acad. 451 (1861). Type in Herb. Acad. Phila.

Caudex dilated below the summit into a globular tuber nearly 2 cm. in diameter; stem 8 dm. or more high, erect, strigose-pubescent, somewhat paniculate above; stipules linear, 1 cm. or less long; leaves 3–5-foliolate, lower petioles as long as the leaflets; leaflets 4–10 cm. long, 8 mm. wide, lanceolate-linear, glandular, glabrous and rugose above, sparingly appressed strigose-pubescent beneath; flowers scattered on a short spike; pedicels nearly 5 mm. long; bracts ovate, cuspidate, about the length of the pedicels; calyx pubescent, conspicuously ciliate with white hairs, covered with brown glands, strongly gibbous-saccate at the upper side, lobes lanceolate, the upper ones the longest. Fruit not seen.

Texas—Lindheimer, Nos. 30, 593 (1847), also No. 44 (1849–50); Ch. Wright, No. 114 (1849); Bandera, Reverchon, No. 1512; Reverchon, No. 813; South of Fort Belknap, Buckley (1861).

The last specimen has very broad leaves, over 15 cm. long, foliaceous stipules and broad scarious scales at the base of the stem.

14. PSORALEA CANESCENS Michx.

Psoralea canescens Michx. Fl. Bor. Am. **2**: 57 (1803). Type in Herb. Michx.

Erect from a long, (rarely 1 m.) fusiform, somewhat farinaceous root, branching, canescent; stipules lanceolate, subulate, less than 1 cm. long; basal leaves 3-foliolate, upper ones often 1-foliolate, sessile or short petioled; leaflets orbicular-obovate narrowed to the petiole, 2–5 cm. or more long, minutely glandular, glabrous above except the somewhat hairy midvein, appressed canescent beneath; peduncles about twice as long as the leaves; flowers in small clusters or scattered in loose spikes; bracts 4–6 mm. long, ovate, acuminate; calyx gibbous on the upper side, covered with brown glands, the lobes triangular, ovate, the two upper ones much shorter than the lower; pod 1 cm. long, glandular, with a straight beak that is somewhat longer than the calyx; seed nearly orbicular, flattish, brown.

North Carolina—M. A. Curtis (1842).

South Carolina—Aikin, Ravenel.

Georgia—Beyrich; Baldwin; Leconte; Buckley; Neisler.

Florida—Buckley; Torrey; between Tallahassee and St. Marks, Rugel (1843); Rosewood, Garber (1876); Chapman; Burrows; pine barrens, Mary Reynolds (1876); near Braidentown, J. H. Simpson (1891); near Jacksonville, Curtiss, N. Am. Pl. No. 557.

Alabama—Ch. Mohr (plants with abnormally large fruit).

15. PSORALEA CUSPIDATA Pursh.

Psoralea cuspidata Pursh, Fl. Am. Sept. 741 (1814). Type in Herb. Acad. Phila.

Psoralea macrorhiza Fras. Cat. (1813), name only.

Psoralea cryptocarpa Torr. and Gray, Fl. N. Am. **1**: 301 (1838).

Psoralea Kœmeriana Scheele, Linnæa, **21**; 463 (1848).

Erect, 4–6 dm. or more high, stout, branching, glabrous below, more or less canescent above; stipules 1–2 cm. long, lanceolate-subulate; leaves 5-foliolate on petioles not longer than the leaflets; leaflets 2–4 cm. long, elliptical-oblong, glandular, glabrous above, canescent beneath; flowers short-pedicelled, crowded in short dense, 3–5 cm. long spikes on peduncles that are longer than the leaves; bracts 1½–2½ cm. long, lanceolate, cuspidate, exceeding the glandular calyx; calyx ciliate or gibbous on the upper side, wide at the sinuses, the two upper lobes shorter than the attenuate, triangular-lanceolate lower ones; pod glabrous, about 8 mm. long, with a short recurved beak, entirely enclosed in the calyx; seed elliptical, 5 mm. long, black or brownish, shiny.

North West Terr.—St. Peter's, Parry (1848); Nicollet, No. 170 (1839).

Dakota—"Upper Missouri River," Buckley (1853).

Kansas—Smoky Hill Fork, Parry, No. 34 (1867); Morton Co., M. A. Carleton, No. 148 (1891); Guerney (1891).

Nebraska—Mouth of the Yellowstone, Hayden, No. 407 (1854).

Indian Terr.—Plains of the Canadian, Bigelow.

Arkansas—Leavenworth.

Texas—Buckley, Drummond, No. 124; Industry, Lindheimer, No. 198 (1844); also No. 372 and 340 (1845); Austin, E. Hall, No. 122; Dallas Co., Reverchon in Curtiss, N. Am. Pl, No.563 **.

New Mexico—Ch. Wright (1851); Cimarron River, on the Santa Fé road, Wislizenus, No. 450 (1846); also Frémont, No. 171 (1845), no locality.

16. PSORALEA PENTAPHYLLA L.

Psoralea pentaphylla L. Sp. Pl. 764 (1753).

Decumbent or assurgent, from long and tuberous rootstocks, stems branching from the base, 1–2 dm. or more long, glandular and more or less hirsute, with short rigid appressed white hairs; petioles 3–5 cm. long; stipules 3 mm. long, lanceolate; leaves 3–5-foliolate; leaflets 1–2½ cm. long, 3–7 mm. wide, lanceolate, sparingly hirsute on both surfaces, less so above; peduncles much shorter than the leaves; flowers 3–8 together in capitate racemes; bracts minute, ovate; calyx-lobes lanceolate, acute; pod over 1 cm. long, hirsute, the straight beak fully half the length of the pod: seed 5 mm. long, elliptical or nearly orbicular, grayish.

Mexico—Near San Luis Potosi, Shaffner, No. 833; Hartweg, No 62; San Luis Potosi, Parry and Palmer, No 142; near Chihuahua, Pringle, No. 17.

17. PSORALEA ESCULENTA Pursh.

Psoralea esculenta Pursh, Fl. Am. Sept. 475 (1814). Type in Herb. Acad. Phila.

Psoralea esculenta Fras. Cat. (1813), name only.

Psoralea brachiata Douglas; Hooker Fl. Bor. Am. 1: 137, *t. 53* (1829).

Root fusiform, 5 cm. or more long, not farinaceous; stems erect, spreading or assurgent, 1–3 dm. high, sometimes acaulescent, with a few scarious scales below, hirsute with somewhat weak hairs; stipules 2 cm. or more long, ovate-lanceolate, ciliate, rarely foliaceous; petioles longer than the leaflets; leaves 5-foliolate; leaflets 2–6 cm. or more long, 1–2½ cm. wide, oblong-cuneate, obtuse or acutish, sometimes mucronulate, glabrous above, hirsute beneath; flowers crowded in oblong spikes 3–8 cm. long on peduncles mostly much longer than the leaves (rarely only as long); bracts 1–1½ cm. long, ovate-lanceolate, cuspidate, hirsute; calyx-lobes 1–1½ cm. long, foliaceous, hirsute, becoming coriaceous with age, the tube strongly gibbous on the upper side, the two upper lobes shorter than the lower ones; pod enclosed in the calyx, hirsute, with the beak nearly 3 times as long as the 6 mm. long black seed.

The Pomme de Prairie and Pomme blanche of the Canadian voyageurs.

Saskatchawan—Bourgeau (1858).

Northwest Terr.—Moose Mt., Macoun; Parry (1848,; Nicollet, No. 169.

Montana—Tweedy (1889).

Iowa—Emmet Co., Cratty.

Wisconsin—Black Earth, Hale (1861); Arena, Hale; Dane Co., J. A. Lapham (1858).

Nebraska—From Niobrara River to Fort Pierre, Hayden (1859); Sage Creek, Hayden (1859); Bad Lands, Hayden (1853); Fort Clark, Hayden (1856); Omaha, Smech (1893); Ellenwood, T. A. Williams; Kearney, Mrs. A. A. Austin; Fort Niobrara, Wilcox; Lancaster Co., Webber.

Missouri—Nuttall; Willard; T. A. Culbertson (1850); G. C. Broadhead (1873); Potosi, Riehl (1846); Allentown, G. W. Letterman (1875); Buckley.

Kansas—Manhattan, Bertha Hederstrow (1892); Fort Riley, E. E. Gayle (1892); Topeka, B. B. Smyth, No. 341 (1891); Manhattan, Kellerman (1888).

Minnesota—Upper St. Peter's, C. C. Parry (1848); Cannon Falls, Sandberg, No. 344 (1891).

Indian Terr.—M. A. Carleton, No. 112 (1891).

Dakota—Box Elder Creek, Rusby (1887).

Texas—Ch. Wright; Dallas, Reverchon; Elihu Hall, No. 121; Hempstead, Elihu Hall, No. 128 (1892); Freestone Co., J. Joor, No. 15 (1878); Prairies of the Rio Grande, Emanuel Meyer; near Nagadoches, Leavenworth; Parry.

Louisiana—Camp Sabine, Leavenworth (1837).

18. PSORALEA HYPOGÆA Nutt.

Psoralea hypogæa Nutt.; Torr. and Gray, Fl. N. Am. 1: 302 (1838). Type in Herb. Columbia College.

Psoralea hypogæa var. *scaposa* A. Gray, Bost. Journ. Nat. Hist. 4: 175 (1850). Type in Herb. Gray.

Roots ovoid, globose or fusiform, 3–4 cm. long, the whole plant sometimes 10 cm. high; stem with a few scarious scales; petioles usually much longer than the leaflets; leaves 5–7-foliolate; leaflets 2–5 cm. long, 5–7 mm. wide, linear-lanceolate, or linear-oblong, acutish, glabrous or with a few scattered hairs above, appressed white hirsute beneath; flowers in capitate racemes varying from nearly sessile to somewhat exceeding the leaves; bracts scarious, ovate, acute, hirsute; calyx-lobes lanceolate, cuspidate, hirsute, the two upper lobes shorter than the lower ones, the middle one of which is broadly lanceolate; pod over 1 cm. long, somewhat hirsute, with a long slender attenuate beak; seed ovoid, about 5 mm. long, wrinkled, reddish brown.

Differing from *P. esculenta* in its smaller size, more rigid and appressed hairs, and narrower leaflets. The pubescence of *P. esculenta* is silky, often nearly woolly and more spreading.

Nebraska—Platte Plains, Nuttall (type).

Indian Terr.—Canadian River, Gordon (1848).

Colorado—Colorado Swamps, Jones, No. 934, (1879); Sandy Plains, Greene (1872).

Texas—West of the Brazos River, Reverchon; Lindheimer, No. 594; Wright, No. 115; Parry (1867), labelled *P. esculenta;* Wright, No. 115 (1849), labelled var. *scaposa;* near Austin, Buckley (1860).

New Mexico—Upper Canadian, A. Gordon (1848); Cold Spring, South of Cimarron River, Wislizenus, No. 478 (1846).

19. PSORALEA SUBACAULIS Torr. and Gray.

Psoralea subacaulis Torr. and Gray, Fl. N. Am. 1: 302 (1838). Type apparently lost.

Nearly acaulescent, 1–2 dm. high from a long subterranean stem, root oblong-fusiform, tuberous, 5–11 cm. long; stem and base of plant covered with large, yellowish, scarious scales; petioles and peduncles villous with silky white spreading hairs; leaves 5–7-foliolate; stipules 1–2 cm. long, ovate-lanceolate; leaflets 1½–3 cm. long, 6–8 mm. wide, obovate-oblong, obtuse or acutish, minutely glandular, glabrous except the ciliate margins and the appressed white-hirsute midvein beneath; peduncles as long or longer than the leaves; flowers purple; bracts ovate-lanceolate, 1–1½ cm. long, ciliate; calyx densely hirsute with white hairs, the lower lobe spatulate, obtuse, the others acutish and shorter. Fruit not seen.

Tennessee—Near Nashville, Gattinger, in Curtiss, N. Am. Pl., No. 559, from the original* locality, where Dr. Roane first collected it; near Nashville, Lesquereux (1855); near Nashville, G. H. Hubbard, No. 559 (1880).

20. PSORALEA CALIFORNICA S. Wats.

Psoralea Californica S. Wats. Proc. Am. Acad. 12: 251 (1876). Type in Herb. Gray.

Psoralea mephitica S. Wats. Proc. Am. Acad. 14: 291 (1879). Type in Herb. Gray.

Root ligneous, 10 cm. or more long; stems 1–2 dm. high, often several from the same root, with a few scarious scales, apparently acaulescent, but spreading or decumbent, sometimes branching from the base, villous with more or less spreading white hairs, especially so on the inflorescence; stipules broadly ovate, scarious; leaves 5-foliolate, on petioles 5–10 cm. long; leaflets 2–3 cm. long, 1–2 cm. wide, rhomboid-obovate or cuneate-obovate, obtuse or retuse, sometimes apiculate, more or less pubescent on both surfaces with appressed short white hairs;

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* Torr. & Gray Fl. N. Am. 1: 302.

peduncles somewhat shorter than the petioles, 2–3 cm. long; flowers on slender lax pedicels, in dense, capitate or elongated spikes; bracts ovate, long-acuminate, scarious, but little shorter than the calyx; calyx conspicuously villous with spreading hairs, somewhat gibbous above, the lobes lanceolate, 8–10 mm. long, the lower lobe the broadest; pod scarious, 1 cm. long, somewhat villous, with a straight slender beak; seed about 5 mm. long, ovoid, greenish or black, smooth and shining.

California—McGinnis Ranch, head of Salinas River, Palmer (1876) type; San Rafael Mts., Santa Barbara Co., H. C. Ford (1887); Head waters of Eel River, Lake Co., Volney Rattan, No. 12 (1884); base of mountains, Mojave region, S. B. & W. F. Parish, No. 1284; Lake Co., M. K. Curran (1884); Mt. Diablo, Geo. W. Davidson (1892); Mt. Diablo, Greene (1892).

Lower California—Japa, Orcutt (1884).

Arizona—Peach Springs, Lemmon, No. 4146 (1884); Buckskin Mts., Jones (1891); Navajo Springs, Jones (1890).

Utah—Beaver City, Palmer, No. 97 (1877); Mrs. Thompson (S. Utah, 1872); Garfield Co., A. L. Siler (1883).

Colorado—Westwater, alt. 4,500 ft., Jones (1891).

21. PSORALEA CASTOREA S. Wats.

Psoralea castorea S. Wats. Proc. Am. Acad. **14**: 291 (1879). Type in Herb. Gray.

Root ligneous, about 8 cm. long; stem erect, 10–15 cm. high with a few scarious scales, the whole plant covered with closely appressed rigid white hairs; stipules ovate-lanceolate, scarious, persistent; petioles 8–10 cm. or more long; leaves 3–5 foliolate; leaflets 3–5 cm. long. 2–5 cm. wide, cuneate-obovate, rounded, retuse or acutish; peduncles shorter than the petioles; flowers in dense capitate spikes about 3 cm. long; bracts ovate or lanceolate, acute, less than 5 mm. long; calyx slightly gibbous above, the four upper lobes lanceolate, attenuate, nearly as long as the cuneate or spatulate lower one, which is over 1 cm. long; pod 8 mm. long, the attenuate beak 14–15 mm. longer; seed about 7 mm. long, flattened, transversely wrinkled, light brown.

In the original description the large lower calyx-lobes have been mistaken for bracts. It differs mainly from *P. Californica* in its closer, whiter pubescence, the size of the bracts, which in the specimens seen were not scarious, the shape of the calyx-lobes, the pod, which again is not scarious and has a much longer and more slender beak, and the wrinkled seed

Prof. M. E. Jones* claims that *P. castorea* and *P. mephitica* are identical, in which I can hardly concur, as the series of specimens examined seem to be very constant to the characters noted above.

Utah—Beaver City, Palmer, No. 96 (1877), type.

California—Mojave River, Parish Bros., No. 1283 (1882); Mojave Desert, Lemmon, No. 3119 (1884); near Colico, Mojave Desert, Lemmon (1884).

§ 2. LEAVES PINNATELY 3-FOLIOLATE (RARELY UNIFOLIOLATE).

Flowers in capitate or short, crowded, oblong spikes.

Flowers small (5 mm. or in *P. simplex* often 1 cm. long).

Pods obliquely orbicular, transversely reticulate or wrinkled.

Leaves 1-foliolate, leaflets linear-lanceolate, bracts setaceous. *22. P. virgata.*

Leaflets and bracts lanceolate and pubescent. *23. P. simplex.*

Pods ovoid, not reticulate.

Plant low, branches trailing. *24. P. rhombifolia.*

Plant erect, leaflets ovate or orbicular, crenate-dentate. *25. P. Americana.*

Flowers large (1–2 cm.).

Plants glabrous or nearly so.

Flowers few, slender pedicelled; pods obliquely ovate, reticulate, stems trailing. *26. P. melanocarpa.*

Flowers in crowded heads; pods ovate, rough, hardly wrinkled. *27. P. rigida.*

Pods ovate, membranaceous, calyx inflated in fruit. *28. P. physodes.*

Leaflets elliptical, stipules large and foliaceous. *29. P. stipulata.*

Plants more or less tomentose or densely pubescent throughout; bracts 15 mm. long, broadly ovate. *30. P. strobilina.*

Flowers in more or less elongated cylindrical spikes.

Flowers small (5 mm.); plants glabrous or nearly so; pods transversely wrinkled.

Leaflets 5 mm.–2 cm. broad, pods nearly 5 mm. long, nearly orbicular. *31. P. pedunculata.*

Leaflets 2½–6 cm. broad; pods nearly 1 cm. long, obliquely ovate, roughened with conical tubercles. *32. P. Onobrychis.*

Flowers large (1–3 cm.).

Plants glabrous or nearly so, stems conspicuously roughened with elevated glands. *33. P. glandulosa.*

Stems glabrous, inflorescence conspicuously villous with white hairs. *34. P. macrostachya.*

Stems prostrate, leaves orbicular or nearly so, very long petioled; infloresence elongated, hirsute. *35. P. orbicularis.*

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*Zoë 2: 244 and 3: 285.

22. PSORALEA VIRGATA Nutt.

Psoralea virgata Nutt. Gen. 2: 104 (1818). Type in Herb. Columbia College.

Psoralea simplicifolia Baldw.; Torr. and Gray, Fl. N. Am. 1: 303 (1838.) Type in Herb. Acad. Phila.

Root small, tuberous; stem erect, 2–6 dm. high, angled, simple or branching from the base, nearly glabrous or the upper part pubescent; stipules setaceous, 5–8 mm. long; leaves remote, 1-foliolate or the radical ones 3-foliolate; petioles shorter than the leaflets; leaflets 3–10 cm. long, 4–10 mm. wide, linear, the basal ones rarely ovate or ovate-lanceolate, glandular, sparingly pubescent on the veins and margins; flowers crowded in short spikes 2–3 cm. long; bracts subulate, nearly twice as long as the calyx-lobes; calyx very small, hirsute, the lower lobe the longest; pod 5 mm. long, obliquely orbicular, compressed, transversely wrinkled, with a minute recurved beak; seed flattish, brown.

Georgia—Near St. Mary's, Baldwin (type).

Florida—Between St. John's and St. Augustine, Rugel, No. 164 (1848). Chapman, no locality; near Jacksonville, Curtiss, No. 553; C. T. Powell (1872); St. Augustine, Mary Reynolds.

Also specimens in Herb. Acad. Phila. from Herb. Baldwin, labelled " *Psoralea angustifolia* U. S. 228. Leaves rarely ternate."

23. PSORALEA SIMPLEX Nutt.

Psoralea simplex Nutt.; Torr. and Gray Fl. N. Am. 1: 303 (1803). Type in Herb. Columbia College.

Erect, simple or one or two stems from the same root, 3–6 dm. high, more or less pubescent throughout; stipules 1 cm. long, setaceous; leaves 3-foliolate, sessile or very short-petioled; leaflets 2–6 cm. long, 5–12 mm. wide, lanceolate, acute, mucronate, glandular; peduncles 2–3 times the length of the leaves; flowers in oblong spikes; bracts very small, linear-lanceolate, acuminate, hirsute with white hairs; calyx hirsute, the lobes somewhat obtuse, the lower one the longest; pod 4–5 mm. long, obliquely orbicular, transversely reticulate; beak somewhat oblique; seed flat, very small, brownish.

Arkansas—Cedar Prairies, Red River, Nuttall (type); Dr. Edwards (1854); Engelmann (1835).

Louisiana—Pointe à la Hache, Langlois (1886); Hale; Paroisse des Rapides, Steinhauer (1839).

"*South Mississippi*"—E. H. Gard. (1859).

Indian Terr.—Near Atoka, C. S. Sheldon, No. 60 (1891).

Texas—Drummond, No. 122 (1835); Wilground, Hempstead, Elihu Hall (1892); Rio de la Trinida y Bejax (1828) lab. *melilitoides*.

24. PSORALEA RHOMBIFOLIA Torr. and Gray.

Psoralea rhombifolia Torr. and Gray, Fl. N. Am. **1**: 303 (1838). Type in Herb. Columbia College.

Decumbent or trailing (rarely erect) from a somewhat thickened root, angled below, sparingly pubescent above; leaves 3-foliolate, on petioles 2–4 cm. or more long, upper ones nearly sessile; stipules 3–5 mm. long, ovate or lanceolate; leaflets 8 mm. to 3 cm. long, ovate-rhomboid (when very small, nearly orbicular), the terminal one acutish, the lateral ones obtuse; flowers dark blue or reddish, in small capitate racemes, on peduncles 3–8 cm. long; bracts about 3 mm. long, elliptical, ciliate; calyx 8 mm. long, somewhat gibbous above, the lobes nearly equal, triangular, acute, spreading; pod mostly 1 cm. long, hirsute, with a long straight beak; seed elliptical, nearly 5 mm. long, brownish, roughened with minute darker glands or tubercles.

Texas—Lindheimer, No. 35 (1843), also 291 (1849–50); Dallas, Reverchon, No. 213 and 563* (1881); Corpus Christi Bay, Palmer, No. 223 (1880); Drummond, No. 134 (type); Ch. Wright; Hockley, F. W. Thuron (1891).

Mexico—Sierra Madre, forty miles east of Saltillo, Palmer, No. 254 (1880); Monterey, Palmer, No. 222.

25. PSORALEA AMERICANA L.

Psoralea Americana L. Sp. Pl. 763 (1753).

Psoralea dentata D.C. Prodr. **2**: 221 (1825).

Psoralea corylifolia Britton, Bull. Torr. Bot. Club, **17**: 313 (1890), not of Linn.

Somewhat shrubby at the base, erect, over 3 dm. high, branching, glabrous, glandular throughout; stipules lanceolate, acuminate; leaves 3-foliolate; petioles 4–6 cm. long; leaflets 2–3½ cm. long, the terminal one sub-orbicular, the lateral ones obliquely ovate, obtuse, irregularly crenate-dentate; racemes spicate, elongated, pubescent, much exceeding the leaves, or when young shorter and almost capitate; bracts lanceolate, shorter than the calyx; calyx-lobes pubescent, the lower one broader and longer than the two short upper ones; pod glabrous, barely longer than the calyx lobes; seed 3 mm. long, densely covered with minute glandular warts.

Florida—Apalachicola, Chapman.

In his description of this plant Linnæus gives America as its habitat. DeCandolle changed the name to *P. dentata*, and gives Madeira as its habitat. Kuntze, in Rev. Gen. Plant i. 193, notes that the plant undoubtedly grows wild on the island of Madeira, and therefore is not American, but re-establishes the Linnæan specific name, though under the generic name of *Lotodes*. The species has been collected in Florida, and doubtless the plant from which Linnæus made his original description came from one of the Southern States. It would be interesting to know how well it is established there. Dr. Chapman's plant is preserved in the Herbarium of Columbia College.

26. PSORALEA MELANOCARPA Benth.

Psoralea melanocarpa Benth.; Hemsl. Biol. Centr. Am. **1**: 234 (1879). Type in Herb. Kew.

Shrubby at the base; stems trailing or spreading, sparingly pubescent with appressed white hairs; stipules 6–10 mm. long, lanceolate, long-acuminate; leaves 3-foliolate; petioles 3–6 cm. long; leaflets, 4–7 cm. long, ovate-lanceolate, acute, mucronulate, glandular, nearly glabrous above, sparingly pubescent beneath; peduncles 12 cm. or more long, exceeding the leaves; racemes oblong; flowers few, slender pedicelled; bracts 6 mm. long, ovate, acuminate; calyx lobes linear, acuminate, nearly as long as the pod; pod obliquely ovate, somewhat twisted, transversely reticulate and somewhat tuberculate, beak short, recurved; seed 3–4 mm. long, elliptical, much smaller than the pod.

Mexico—Coulter, No. 561; Parry & Palmer, No. 142; near Montery, Pringle, No. 2275 (1888).

27. PSORALEA RIGIDA Parish.

Psoralea rigida Parish, Bull. Torr. Bot. Club, **19**: 91 (1892).

Erect, 3–6 dm. high, glandular, sparsely villous, with short intermingled black and white hairs; petioles 2 cm. or more long; stipules lanceolate, leaflets ovate-lanceolate, 3–5 cm. or more long, glabrous, rigid; peduncles shorter than the leaves; flowers in capitate racemes; bracts lanceolate, much shorter than the flowers; calyx 1 cm. long, lobes acuminate, the upper one much the longest; pod 8–10 mm. long, ovoid, coriaceous, with a short, stout, straight beak (under a lens, with a few white hairs); seed elliptical, 7 mm. long, black.

California—Oak Grove, San Diego Co., Parish, No. 643 (1882).

28. PSORALEA PHYSODES Douglas.

Psoralea physodes Douglas; Hook. Fl. Bor. Am. 1: 136 (1830).

Erect, simple, 3–5 dm. high, glabrous or with a few weak, mostly black hairs; stipules 4–6 mm. long, lanceolate, reflexed; leaves 3-foliolate; leaflets 2½–5 cm. long, 2–3 cm. wide, broadly rhomboid-ovate, acute, mucronate, glandular; peduncles 3–9 cm. long; flowers in capitate racemes; bracts 5 mm. long, elliptical; calyx 8–10 mm. long, inflated, lobes triangular, glabrous, the margins ciliate with dark hairs; pod membranaceous, 5 mm. long, somewhat compressed (under a lens, with a few scattered black hairs), seed greyish.

British Columbia—Near Victoria, Fletcher (1885).

Oregon—Wahlamet, Nuttall; Portland, L. F. Henderson, No. 10; San Juan Island, Lyall (1858); Tolmie; E. Hall, No. 106 (1871); Douglas; Brushlands, Howell (1880).

Washington—Pugallup, Puget Sound, Engelmann (1880); J. M. Grant (1880); Port Townsend, Th. Meehan (1883).

California—Near Monterey, Brewer, No. 673; Gavillari Peak, Brewer, No. 752; Walnut Creek, Brewer, No. 1032; New Almaden, Torrey, No. 111 bis (1865); Samuels; Douglas; East of Cascade Mountains, Wilkes, No. 454; near Auburn, Lemmon (1883); Oakland Hills, Bolander (1861); Mack West's Creek, Bigelow (1853–4); Bridges, No. 75; Monterey, Parry (1850).

29. PSORALEA STIPULATA Torr. and Gray.

Psoralea stipulata Torr. and Gray, Fl. N. Am. 1: 688 (1840). Type in Herb. Columbia College.

Ascending, branching from the base, 3–5 dm. high, not glandular, nearly glabrous; petioles 2–3 cm. long; leaves 3-foliolate; stipules 1–1½ cm. long, foliaceous, lanceolate-ovate or elliptical; leaflets 3–4½ cm. long, ovate or elliptical, obtuse, mucronulate, reticulate beneath; peduncles about as long as the leaves; racemes capitate; bracts 5–10 mm. long, ovate, cuspidate, somewhat scarious, deciduous; calyx slightly pubescent, the lower lobe the longest. Fruit not seen.

Ohio—Falls of the Ohio, Rock Island, Wm. Jones (June 8, 1839, type); Rock Island, Short (1840–60).

Indiana—New Albany, A. Clapp.

In the collections of C. W. Short, preserved in the Herb. Acad. Phila., there are notes to the effect that he never found this plant in fruit growing wild, and that he cultivated it vainly for years. His collections of *P. stipulata* in the herbaria examined, cover a period of some twenty years.

30. PSORALEA STROBILINA Hook. and Arn.

Psoralea strobilina Hook. and Arn. Bot. Beechey 332 (1840).

Psoralea macrostachya β Torr. and Gray, Fl. N. Am. **1**: 304 (1838) not of D.C.

Stems 6–9 dm. high, striate, tomentose and glandular throughout; stipules over 1 cm. long, ovate, cuspidate, ciliate, somewhat scarious; petioles 3–6 cm. or more long; leaves 3-foliolate; leaflets 3–7 cm. long, ovate or oval, the terminal one somewhat rhomboid, acutish, sometimes obtuse, rarely mucronulate, pubescent above with black glands, tomentose beneath; peduncles exceeding the leaves; spikes 2–5 cm. long, oblong, densely hirsute; bracts over 1½ cm. long, broadly ovate, acuminate, hirsute, mostly enclosing the flower; calyx-lobes lanceolate, cuspidate, the lower lobes broader and longer than the attenuate upper ones; fruit not seen.

California—Douglas (type); Roadsides to Santa Cruz, Bolander; Oakland Hills, near San Francisco, Torrey, No. 113 bis.

31. PSORALEA PEDUNCULATA (Mill.).

Hedysarum pedunculatum Mill. Gardn. Dict. No. 17 (1768), not *Psoralea pedunculata* Ker, Bot. Reg. t. 228 (1817), which is *P. sericea* Poir. (1804.) Type in Herb. Mus. Br.

Trifolium psoralioides Walt. Fl. Car. 184 (1788). Type apparently lost.

Psoralea melilotoides Michx. Fl. Bor. Am. **2**: 58 (1803). Type in Herb. Michx.

Psoralea Melilotus Pers. Syn. **2**: 347 (1807).

Melilotus psoralioides Nutt. Gen. **2**: 104 (1818).

Psoralea eglandulosa Ell. Bot. N. C. and Ga. **2**:198 (1824).

Psoralea gracilis Chapm.; Torr. and Gray, Fl. N. Am. **1**: 303 (1838). Type in Herb. Columbia College.

Erect, 3–8 dm. high, from a long rootstock, simple or branching from the base; stipules 4–5 mm. long, setaceous; petioles shorter than the leaflets; leaves remote, 3-foliolate, rarely 4–5-foliolate; leaflets 4–7 cm. long, 1–2 cm. wide, lanceolate, acute, rarely ovate and obtuse, glabrous except the veins and margins, which are very sparingly hirsute; peduncles much exceeding the leaves; flowers in loose spikes; bracts 1 cm. long, glandular, broadly ovate, much imbricated, the cuspidate apex longer than the flowers; calyx-lobes acute, glandular, the lower lobe the longest; pod 4 mm. long, 5 mm. wide, nearly orbicular, compressed, ransversely wrinkled with a minute recurved beak; seed orbicular, flat, brown.*

[There is a specimen of this plant in the Linnæan Herbarium in the place of *Hedysarum viridiflorum* L., as indicated on the sheet by Dr. Asa Gray. It is out of place, however; the specimen of *Hedysarum viridiflorum* on which Linnæus founded the species is the plant of Gronovius preserved in the Herbarium of the British Museum of Natural History, and is *Meibomia viridiflora* (L.) Kuntze. N. L. B.]

Washington—Seattle, Ch. V. Piper., No. 58 (1891).

Indiana—New Albany, A. Clapp.

Illinois—Rafinesque in Herb. Acad. Phila; Salem, W. S. Bebb; Maysville, Buckley (labelled "*eglandulosa*").

Missouri—Jefferson City, Knause (1869); Garden Gap, Frank Bush (1888); Paris Springs, J. W. Blankinship (1887).

Kansas—Cherokee Co., J. H. Oyster, No. 2133 (1887).

Virginia—Petersburg, M. Tuomey; near Suffolk, A. Heller, No. 959 (1893).

North Carolina—Near Salisbury, A. A. Heller, No. 30 (1890).

South Carolina—Beck (labelled '*P. lanceolata*); Pine Barrens, near Society Hill, John Donnell Smith.

Georgia—Jessup Co., T. H. Kearney (1893).

Kentucky—Oaklands, Short; Big-hill, Madison Co., Short.

Tennessee—Near Dandridge, Rugel (1842, labelled *P. eglandulosa* Ell.).

Arkansas—Nuttall; F. L. Harvey, No. 13 (a monstrosity with foliaceous calyx-lobes in Herb. Gray; Pitcher.

Georgia—Baldwin; Leconte; S. H. Wright.

Louisiana—Hall; Carpenter (1841).

Alabama—Buckley (1847); Thomas W. Peters; La Grange, N. R. Hatch; G. R. Vasey (1878).

Florida—Chapman; between Quincy and Chattahoochee, Chapman (1836); Quincy, Chapman, (lab. var. *gracilis*).

Texas—Wright; (also, Wright sp., lab. *P. eglandulosa* in Herb. Gray); Denison, J. H. Oyster (1883).

32. PSORALEA ONOBRYCHIS Nutt.

Psoralea Onobrychis Nutt. Gen. **2**: 104 (1818).

Stylosanthes racemosa Nutt.Fras. Cat. (1813), name only.

Psoralea (?) *latifolia* Torr. Ann. Lyc. N. Y. **2**: 176 (1828).

Erect, 1–1½ m. or more high, more or less finely pubescent throughout; petioles 4–7 cm. or more long; stipules 8–10 mm. long, setaceous; leaves 3-foliolate; leaflets 5–10 cm. or more long, 2½–6 cm. wide, ovate, acuminate, nearly glabrous above, ciliate, sparingly pubescent with scattered hairs beneath; peduncles much exceeding the leaves; spikes long, slender; flowers scattered, very small; bracts 3 mm. long, setaceous; calyx-lobes obtuse; pod 1 cm. long, ovate, black, slightly twisted at the apex, transversely reticulate, roughened with conical tubercles; seed elliptical, 6 mm. long, red brown.

Canada—Nicolet (1841); Near Ottawa, M. S. Bebb (1879).

Indiana—New Albany, A. Clapp.

Illinois—Peoria, A. J. Heading; Menard Co., Hall (1861); Athens, Hall (1863); Pekin, No. 8 (1837), collector unknown.

Ohio—Columbus, Sullivant (1840); Columbus, J. A. Lapham.

Missouri—Beck; H. Eggert (1877); near St. Louis, Baldwin; St. Louis, Engelmann (1841).

Tennessee—Between Dandridge and Knoxville, Rugel (1842); Knox Co., T. H. Kearney (1893).

Kentucky—High cliffs, Kentucky River, Short.

33. PSORALEA GLANDULOSA L.

Psoralea glandulosa L. Sp. Pl. Ed. 2, 1075 (1763).

Psoralea lutea Molina, Sagg. 163 (1782).

Psoralea Cullen Poir. Encycl. **5**: 685 (1804).

A low shrub, 1 m. or more high, glabrous (except the racemes), covered throughout with elevated black glands; leaves 3-foliolate, on petioles somewhat shorter or the length of the leaflets; leaflets, lanceolate or ovate-lanceolate, acute, 3–5 cm. long, 1–1½ cm.

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* In the Schweinitz Herbarium there is a specimen labelled *P. peduncularis* Raf. I have not been able to find a published reference to that name.

wide; stipules minute, subulate; racemes 10–15 cm. long, usually much longer than the leaves; bracts 3 mm. long, ovate, cuspidate; calyx-lobes conspicuously nerved, acute, glabrous, nearly equal; pods exceeding the calyx-lobes, elliptical, hirsute, with a short, straight beak; seed 5 mm. long, elliptical, brown.

Chili—Dr. Styles, near Santiago, Ball (1882); Reynolds; Capt. Wilkes (1838–42); Gay; Mertens; Gillies, No. 257; W. Lechler; Valparaiso, Wilkes; near Valparaiso, Rusby, No. 956; G. Kunze (1839); W. H. Statin (1884–85).

California—Near Berkeley, Greene (1881).

34. PSORALEA MACROSTACHYA DC.

Psoralea macrostachya D.C. Prod. 2: 220 (1825).

Erect, 3 dm. to 3 m. high, branching, the stems glabrous or nearly so, otherwise the pubescence very variable; stipules 3–4 mm. long, subulate; leaves 3–foliate; leaflets 2–8 cm. or more long, 1–7 cm. wide, ovate or ovate-lanceolate, acute, from nearly glabrous to cinereous-pubescent; glands scattered, black; peduncles 4–30 cm. or more long, glandular; spikes cylindrical; bracts 5 mm. long, ovate, cuspidate, scarious, soon deciduous; calyx densely villous with silky white hairs, the lower lobe attenuate and longer than the upper one; pod 8 mm. long, obliquely ovate, acute, pubescent, with a weak recurved beak; seed 4–5 mm. long, elliptical, black.

California—San Diego Co., San Filipe Cañon, Palmer, No. 63; San Bernardino, G. W. Wright, No. 162; Brewer, No. 679; Yosemite Valley, Torrey, No. 111 bis. (1865); Indian Springs, Nevada Co., G. W. Wright (1875); Douglas (with very pubescent, almost tomentose leaflets); Ray Cañon, near Shasta, Brewer, No. 1322 (leaflets varying from glabrous or cinereous to nearly tomentose); Ojai Ch. Creek, Rothrock, No. 172 (1875); Sacramento River, Wilkes, Nos. 1297 and 1632 (labelled var. *rhombifolia*); Frémont (1843–47); Parry and Lemmon, No. 84 (1876); Palmer No. 69 (1875); San Filipe, Southern San Diego Co., Palmer No. 63 (1875); San Luis Rey, Parry, (1850); Colorado Desert, Orcutt, (1889); W. R. Prince (1854); Thomas Bridges, No. 74.

Lower California—Santo Thomas, Orcutt (1885); All Saints Bay, Miss F. E. Fish (1882); San Bernardino, S. B. and W. F. Parish, No. 1075 (1881); Wislizenus (1851).

35. PSORALEA ORBICULARIS Lindley.

Psoralea orbicularis Lindley, Bot. Reg. **23**: t. 1971 (1837).

Stem prostrate, creeping, the leaves and racemes erect, glandular throughout; stipules ovate, inconspicuous; leaves 3-foliolate; petioles 2–5 dm. long; leaflets 3–8 cm. long, 3–7 cm. wide, the terminal one nearly orbicular, the lateral ones obovate and obtuse, glabrous and reticulate or pubescent, entire or rarely with broad undulate lobes; peduncles mostly exceeding the leaves; flowers in dense, hirsute spikes, 5–30 cm. long; bracts 1–1½ cm. broad, oblong-lanceolate, scarious, ciliate; calyx-lobes lanceolate, attenuate, the lower lobe often 2 cm. long; pod about 8 mm. long, somewhat inflated, hirsute, with a very small straight beak; seed elliptical, light brown.

California—Wallace (1858); Douglas; Pratten; Bolinas Bay, Kellogg (1866), labelled "*P. rotundifolia;*" Yosemite Valley and mountains, Torrey, No. 112 bis (1865); Brewer; Sprague's Ranch, Yosemite, Lemmon; Indian Spring, Nevada Co., G. W. Wright (1875); Upper Sacramento, Wilkes (1838–42); Sonoma Co., E. Samuels; Vasey (1875); Cuiamaca Mts., southern part of San Diego Co., Palmer, No. 64 (1875); Monterey, Major Rich; Southern Upper California, A. Fitch; Mr. Shelton; "Near American Fork," Frémont, No. 496 (1846); San Bernardino Valley, S. B. and W. F. Parish (1887).

PSORALEA MULTIJUGA Ell. Bot. S. C. and Ga. **2**: 198 (1824).

The type specimen of this species preserved in Elliott's herbarium at the College of Charleston, Charleston, S. C., was examined by Dr. Britton and Mr. Small in January, 1894, and proved to be *Astragalus glaber* Michx.

Additional Mexican species of which I have not seen specimens and to which I have not been able to see the descriptions or find satisfactory reference.

PSORALEA HUMILIS Mill. Gard. Dict. (Ed. 8), No. 7—Mexico.

PSORALEA SPINESCENS Benth.—Mexico. (No other citation in manuscript of Kew Index.)

SOUTH AMERICAN SPECIES.

PSORALEA AZUREA R. Philippi, Fl. Ataca. **14**: (1860). Chili.

PSORALEA BRACHYSTACHYA. Spruce, No. 5145 (1857–9). Andes of Ecuador, name apparently unpublished.

PSORALEA DIVARICATA H. and B.; Willd. Enum. 788 (1809). Peru.

PSORALEA HIGUERILLA Gillies; Hook. and Arn., in Hooker, Bot. Misc. **3**: 181 (1838). Argentine Republic.

PSORALEA LASIOSTACHYS Vogel, Nov. Act. Acad. Cur. **19**: Suppl. 1: 13 (1843). Peru, and probably also Bolivia.

PSORALEA MARGINATA Meyen, Reise, **1**: 436. Peru.

PSORALEA MEXICANA (L.)

Indigofera Mexicana Linn., Suppl. 335 (1781).

Psoralea Mutisii Kunth, Plant. Legum. **1**: 91, t. 54 (1819–24), fide H. B. K. **6**: 487 (1823). New Grenada.

PSORALEA PUBESCENS Pers. Syn. Pl. **2**: 347 (1807). Peru and Ecuador.

PSORALEA TRIANÆ n. sp.

Shrubby, slender, stems tomentose; stipules 6 mm. long, lanceolate, tomentose in the exterior; leaves 3-foliolate; petioles mostly shorter than the leaflets; leaflets 3–5 cm. or more long, lanceolate-oblong, acuminate, glandular, nearly glabrous above, tomentose beneath; flowers in interrupted cylindrical spikes exceeding the leaves; bracts 5 mm. long, ovate, densely covered on the outer surface with dark hairs, as well as the calyx; calyx 3–5 mm. long, the lobes acute; pod not seen.

New Grenada—Near Pasto, alt. 2,500 m., J. Triana (1851–1857).

PSORALEA WEDDELLIANA Baillon, Adansonia, **9**: 292 (1868–70) Brazil.

This study was begun at the suggestion of Dr. N. L. Britton, and I am indebted to him for his help and much valuable advice.

The Herbaria examined have been those of Columbia College, Harvard College, the Academy of Science of Philadelphia, the State Herbarium at Washington, and that of the Shaw Botanic Garden; and I am under obligation to Dr. Robinson, Mr. Redfield, Mr. Coville and Prof. Trelease for their courtesy in allowing me the use of the collections in their charge.

Messrs. W. B. Hemsley, S. B. Parish, P. A. Rydberg and M. E. Jones have also very kindly supplied me with specimens and field notes, and Dr. H. H. Rusby with references from the MSS. of the Kew Index.

Notes on certain Plants of our Eastern Flora.

RUBUS MONTANUS (*R. villosus montanus* Porter, in BULLETIN 17: 15). Recent observations on this *Rubus* in its native haunts has led me to believe it worthy of elevation to specific rank. Its slender stalks are less prickly than those of *R. villosus* and usually reddish, but the chief difference lies in the fruit, which is much smaller, of oblong shape, often narrowed toward the apex (thimble-like), scarcely fleshy and possessed of a peculiar spicy flavor.

Common and abundant on the mountains of New York and Pennsylvania, where it is popularly known as the "mountain blackberry." It no doubt extends further south.

Solidago Canadensis L.—To this species must probably be referred specimens collected last summer by Mr. J. H. Redfield near Long Pond, Mt. Desert Island, Maine. Sent me under the name of *S. serotina*, they are clearly separated from it by their low, slender, pubescent stems, narrower, more numerous, long-acuminate, triple-nerved leaves, smaller panicles and smaller heads, with acute involucral bracts and shorter rays. The very same form occurs also in Pennsylvania at several stations along the Susquehanna river, and shows a near approach to *S. rupestris* Raf., which Dr. Gray, in the Synoptical Flora, surmises may prove to be "an extreme form of *S. Canadensis*." If this view be adopted, Mr. Redfield's plant must take the varietal name *rupestris* (Raf.).

ASTER CORDIFOLIUS L.—Most frequent and plentiful in our Middle States. It blooms profusely, adorning the woods and fields during the months of September and October. From the allied species it is readily distinguished by its foliage. The radical and lower cauline leaves are orbicular-cordate or oblong-cordate, scabrous above and beneath, thin and membranaceous in the shade, thicker and stiffer in open grounds, coarsely serrate, and with petioles not at all, or only slightly, margined.

A. CORDIFOLIUS POLYCEPHALUS n. var.—More robust and branched than the type; leaves smaller, the upper ones and the bracts ovate and sessile; panicle ample; heads usually smaller and very numerous; rays deep blue and the disk-florets dark purple (as in *A. lateriflorus*), or both of them sometimes pale or whitish.

Everywhere with the typical form in New Jersey and Eastern Pennsylvania, and its different aspect at once catches the eye of an observer.

Aster Lowrieanus (*A. leiophyllus* Porter). The good and fit name for this species, published in the Bulletin (**20**: 254), being antedated by *A. leiophyllus* Franch. & Sav. (Enum. Fl. Jap.), is here replaced by another, given in honor of the late J. Roberts Lowrie, who contributed largely to our knowledge of the plants of Central Pennsylvania. The varieties noted in the article of the Bulletin just cited must follow this change and become respectively *A. Lowrieanus lanceolatus* Porter and *A. Lowrieanus incisus* (Britton). Two small specimens of the typical plant, lately gathered, exhibit amongst heads of the usual size a few that are much larger than the others and like those of *A. lævis*, to which it is related also by the smoothness and leathery texture of the leaves.

Aster lævis L.—Running through the multitudinous forms of this species, as represented in the Eastern United States, are two marked lines of variation, recognized by Dr. Gray in the fifth edition of his Manual, but in the Synoptical Flora embraced under a single general description. His earlier judgment seems to me better and more consistent. The type of the species (*A. cyaneus* Hoff.) has ovate leaves of moderate breadth, the lower ones abruptly narrowed toward a clasping base. Then comes the variety *lævigatus* (Willd.), with linear-oblong leaves, sometimes from 5 to 7 inches in length, and gradually narrowed to a slender, scarcely-auricled base, often thin and not glaucous; and then a second one, with much shorter large broad-ovate leaves, little contracted below and strongly amplexicaul, for which the name *latifolia* is very suitable. Specimens of this variety exist in the Torrey Herbarium, and it has also been collected in the neighborhood of Easton, Pa.

Vaccinium Pennsylvanicum Lam.—White fruit of this species was obtained last July near Pocono Summit, Monroe county, Pa. The color of the berries was not indeed pure white, for, although fully ripe, they were slightly greenish, and many of them had a faint pinkish tint, and all were pale and somewhat translucent. The huckleberry-pickers of the region say they occasionally meet with patches bearing fruit of the sort. Hence it appears that such albinoism in the tribe is not confined to *Gaylussacia resinosa.*

MYOSOTIS CÆSPITOSA Schultz.—First found by me (with stout stems and leaves only), submersed in a limestone spring near Mercersburg, Franklin county, Pa., in May, 1852, and next, in a similar spring and in the same condition, near Stroudsburg, Monroe County, by my friend, Mr. T. Dunkin Paret, on the 19th of November, 1891. It has been a long-standing puzzle. The leaves, all under water, were perfectly smooth, and I mistook the plant for *Veronica Anagallis* L. in the young stage. Later (in November, 1892) Mr. Paret sent it to me, with emersed stems and branches, in flower and fruit. These and the leaves covered with scattered and appressed hairs at once showed it to be a *Myosotis.* It agrees well with the characters given for *M. cæspitosa,* and cannot be a form of *M. laxa,* Lehm.

Mentha gentilis L.—Another foreigner, which has come to stay. It is fully naturalized in and around Tobyhanna Mills, Monroe county, Pa., and on the shores of the Delaware above and below Easton, as well as in the gardens and waste places of the city. The larger and older leaves are often mottled with white, as noted by Smith in his English Flora.

CAREX MEADII Dewey. (*C. tetanica Meadii* (Olney) Bailey).

On the 7th of June, 1893, at the invitation of Dr. C. D. Fretz, and accompanied by Drs. Moyer and Thomas, I visited an extensive marshy meadow in the trap-rock reagion, some miles southwest of Sellersville, Bucks county, Pa., in order to obtain this *Carex,* and found it growing there in great abundance and in fine condition. An ample stock of it was secured, including a number of diverse forms, and the study of these forms, in comparison with specimens from other stations east and west, has convinced me that it is entitled to retain its old rank as a distinct species. Although sought for, no typical *tetanica,* nor any approach to it, could be discovered. The results of my studies are embodied in the following description:

Pale green and minutely scabrous; culms rather stout and rigid, 12 to 18 inches high; leaves crowded at the base, stiff, erect, keeled, about 2 lines wide, tapering into a long acumination, the lowest at times exceeding the culm, the others much shorter; staminate spike thick, peduncled or subtended by a small almost sessile scarcely-bracted pistillate one; pistillate spikes single, but oftener two, and frequently three, the lower ones with conspicuous bracts and on slender, exserted peduncles, of which the lowest rarely starts from near the base and is very much elongated (as happens also in the allied *C. polymorpha*), all of them sometimes staminate at the apex (*C. Carteri* Porter): perigynia crowded above, looser below, turgid, deep olive-green, nerved, globular, with a very short, more or less curved beak, or else narrowed upward and somewhat ovoid (*C. tetanica Canbyi* (Olney) Porter), both kinds being occasionally found in the same spike; scales broad, with brownish-purple margins, very obtuse, with or without rough awns, lower ones as long or longer than the perigynia, middle and upper ones shorter or even half as long.

From *C. polymorpha* it is distinguished by its rigid habit, smaller and narrower leaves and the much shorter beak of the perigynium, and from *C. tetanica*, by its stiffer habit, shorter and broader staminate and pistillate spikes, turgid and usually globular shorter-beaked perigynia, and the deep-colored margins of the scales.

THOS. C. PORTER.

An Examination of the Pubescence of the Styles and Filaments of Lonicera hirsuta Eaton, L. Sullivantii Gray and L. glauca Hill.

BY A. A. TYLER.

(PLATES 181 AND 182.)

As to the pubescence of the styles and filaments of *Lonicera hirsuta* Eaton, *L. Sullivantii* Gray, and *L. glauca* Hill, the characters given in Gray's Manual of Botany are:

"*L. hirsuta*, lower part of filaments hirsute."

"*L. Sullivantii*, filaments nearly glabrous."

"*L. glauca*, style and base of filaments hirsute."

With a view to determining, if possible, whether these characters are correct and possess the distinctive value usually given them, I have made an examination of the specimens of the three species in the herbarium of Columbia College, kindly furnished by Dr. Britton, at whose suggestion this examination has been undertaken. Not all the specimens of *L. hirsuta*, however, were included among those examined. The specimens in the herbarium of Lafayette College have been examined as well, and the results are given with some conclusions drawn from them.

Only a part of the specimens have been figured, the great similarity of many making more figures unnecessary. The filaments are uniformly lettered *a* in the figures, and are shown only as far as the point of adnation, except in figure five, which represents as well part of the adnate portion of the filament, with overlying epidermis torn loose from its attachment to the corolla. The styles are uniformly lettered *b*. In making notes I have not confined myself wholly to the characters in question, as some of the others may shed additional light on the problem.

The plants examined include *L. hirsuta* from the following localities:

Saskatchawan. Scattered hairs on lower half of filament; style rather densely hirsute above, but the hairs thinning out below (Fig. 1). Corolla not glabrous on the outside; leaves pubescent beneath.

Black Hills, Dakota. Filaments sparsely hirsute at base, extending a third of the way up; style densely hirsute in its entire length (Fig. 2). Leaves glaucous and somewhat pubescent below; corolla tube long and narrow, yellow, not glabrous outside.

Middlebury, Vermont. Filaments with long hairs scattered over the greater part of the length but most thickly at base; style thinly hirsute throughout (Fig. 3). Yellow corolla, calyx and upper part of stem glandular pubescent; leaves pubescent on both sides and ciliate-fringed, broadly oval, pale glaucous beneath.

Ashland, Nebraska. Filaments glabrous but with a single hair on each of two; style densely hirsute throughout, as in Fig. 2. Leaves pubescent beneath, not glaucous; corolla tube long and narrow, not glabrous outside.

Ishpening, Michigan. Scattered hairs on the lower half of the filament, as in Fig. 1; style densely hirsute throughout, as in Fig. 2. General characters as in the Vermont specimen.

Isle Royale, Lake Superior. Filament and style as in the last; leaves nearly glabrous above, glandular pubescence of corolla less dense.

Oswego, New York. Filament with hairs scattered over the greater part of the length; style thinly hirsute throughout, in both cases as in Fig. 3, but slightly denser. Corolla purplish, *hirsute on the outside but not glandular;* leaves thickish, glabrous, glaucous beneath.

Monroe county, Pennsylvania. Filaments with a few hairs at the base, as in Fig. 6; style wholly glabrous. General characters as in the Vermont specimen.

Lycoming county, Pennsylvania. Filament sparsely hirsute a third of the way up; style hirsute throughout, as in Fig. 2. Corolla glandular pubescent outside, leaves pubescent beneath.

Clearfield county, Pennsylvania. Filament with scattered hairs, except near the top, as in Fig. 3. General characters as in the Vermont plant.

Armstrong county, Pennsylvania. Filament pubescent on lower third; style densely hirsute throughout, as in Fig. 2. Corolla purplish, glandular pubescent outside; leaves thickish and pubescent only below; also pale glaucous below.

Fayette county, Pennsylvania. Filament hairy at base, as in Fig. 2; style hirsute throughout, somewhat less densely than in Fig. 2. Corolla glandular pubescent on the outside. Leaves glabrous, pale glaucous below.

But one specimen of *L. Sullivantii* was available for examination, and that being one of the type-specimens from the Columbia College Herbarium naturally corresponds with the description of Dr. Gray, and we can arrive at no definite conclusion with regard to it. The filament and style of this plant are shown in Fig. 4. The upper part of the style exhibits a few scattered hairs which are not mentioned in the description of the species.

In the specimens of *L. glauca* examined the outside of the corolla and the leaves are uniformly glabrous and the latter glaucous beneath; tube of corolla short, gibbous at base; flowers usually purplish. Flowers were examined from plants collected in the following localities:

Narrowsville, Bucks county, Pennsylvania. Both filaments and style wholly glabrous with the exception of two hairs near the base of the style of a single specimen (Fig. 5).

Charles City, Iowa. Filament with a few scattered hairs at the base; style thinly hirsute throughout (Fig. 6).

Navy Island, New York. Filaments covered nearly half way up with long fine pubescence. Style wholly glabrous (Fig. 7).

Lake Superior, of Dr. Gray's collection. Filaments slightly bearded at base with a few scattered hairs on the style (Fig. 8), tube of corolla long and narrow.

Chapman's specimen, also from Navy Island, has the same characters as the other (Fig. 7).

Wautauga River, North Carolina. Filament and style wholly glabrous, as in Fig. 5.

Blair county, Pennsylvania. Filament and style glabrous.

Huntingdon county, Pennsylvania. Filament glabrous; style with scattered hairs, intermediate between Figs. 6 and 8.

Easton, Pennsylvania. Filament hairy at base, as in Fig. 2; style glabrous.

Lancaster county, Pennsylvania. Filament and style wholly glabrous.

Of the twelve specimens of *L. hirsuta* examined, ten have the filaments hirsute or more sparingly hairy at base, often with hairs more thinly distributed nearly to the top, one has glabrous filaments, and one has but a few hairs at the base. The styles in ten of the plants are more or less densely hirsute throughout, one is glabrous, and one but slightly hairy at a point near the base.

Of the ten specimens of *L. glauca* five were found to have glabrous filaments, two had fine pubescence on the lower half and three were more or less hairy at base. The styles were glabrous in seven specimens; in two, thinly hirsute throughout; in one, with scattered hairs.

It, therefore, appears that the characters under consideration are variable, especially in *L. glauca*, but may with safety be given as follows: *L. hirsuta*, style and base of filament usually hirsute, but occasionally glabrous or nearly so; *L. glauca*, style and filaments usually glabrous, but the style sometimes more or less hairy, and base of filaments hairy or pubescent.

Germination of the Spores of Cerebella Paspali.

By Geo. F. Atkinson.

(Plate 183.)

Specimens of *Cerebella Paspali* C. & M. were collected by the the writer in August, 1891, at Auburn, Ala., on *Paspalum platycaule.* Since there is some doubt as to the relationship of this genus to the other genera of the Ustilagineæ, it seemed well in the spring of 1892 to undertake the germination of the spores, that their behavior under those circumstances might be observed.

Cultures were made in Van Tieghem cells in water, and the development of the mycelium carefully traced. The first sowing was made April 2d, and in twenty-four hours the spores were germinating, as shown in figures 2 and 3. One or all of the cells of the glomerules, or spore balls, may germinate. The germ tubes are rich in granular protoplasm, and are also abundantly supplied during their early growth with quite numerous highly refringent granules. Septa arise also quite early, dividing the threads into cells, which are at first in length two or three times their diameter. Later they may become shorter by further division. These threads, which are homologous with the promycelium of the Ustilagineæ in common, do not seem to function as promycelia in the ordinary sense, *i. e.*, they do not bear sporidia. On the other hand, quite an extended weft of mycelium is developed and the threads branch profusely. Frequently, where threads or their branches from the same spore ball or from different spore balls come in contact fusion takes place in the same manner as in the mycelium of many of the pyrenomycetous and hyphomycetous fungi. Figures 4 and 5 show quite an extended growth of mycelium from two spore balls, which at figure 6 is fusing in several places. In a few days vacuoles appear in the protoplasm of the thread cells, which become more and more prominent with the age of the thread. At the same time the older cells become strongly constricted at the septa, so that the individual cells, which are now shorter by the formation of intermediate septa, are nearly oval in form. Also the mycelium now begins to darken and in the cell cultures became of a reddish brown color much the same as the color of the mycelium found in the sori at the maturity of the fungus on its host.

Dilution cultures for the separation of the fungus were started in ordinary nutrient agar-agar. The spores germinated well, but no sporidia were developed, and in the course of a week a portion of the mycelium was transplanted to dead cornstalk pith which had been saturated with agar. Here the fungus grew profusely, but did not fruit, the substratum probably being not of the proper nature to encourage the normal development of the plant. After two weeks' growth the mycelium was examined, and a small portion of it is represented in figure 7. The older portions now present a moniliform appearance, the cells possessing very large vacuoles and the walls being very brown in color.

The genus *Cerebella* was first described by Cesati from specimens on *Andropogon Ischæmi* in Italy, and was supposed to be related to certain of the Hyphomycetes, as *Sporodesmium*.* Berkley† suggested its relationship with *Polycystis*. De Toni‡ places it among the Ustilagineæ, and suggests its close relationship with *Urocystis* or *Thecaphora*. The appearance of the spore balls suggests a much closer relationship with *Thecaphora* than with *Urocystis*, but the germination of the spores does not show a very close relationship with either, and the mycelium from the spore is very different from the promycelium of either *Urocystis* or *Thecaphora*. The failure to produce sporidia would not form a very strong argument against the location of this plant in the Ustilagineæ, since Brefeld § found that the dusty smut of barley and the smut of wheat did not in nutrient solutions produce sporidia. But certain characters of the mycelium would seem to favor its exclusion from the Ustilagineæ, but this will be still a matter of doubt until the other species of the genus have been studied.

Botanical Department, Cornell University.

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* Saccardo Syll. Fung. 4 : 761.

† Gardeners' Chronicle, 1852, 643.

‡ Sacc. Syll. Fung. 7 : 2, 515.

§ Journ. Mycol. 6 : 1890–91, 153 (translation from the Nachrichten aus dem Klub der Landwirthe zu Berlin, Nos. 220–222).

Shrinkage of Leaves in Drying.*

(PLATE 184.)

While it is well known that foliage undergoes a shrinkage in the ordinary process of drying, the amount has not heretofore been considered great or perhaps worthy of mention. The Solandi process of sun printing previously considered (see page 485 of the BULLETIN Vol. 20), permits of an accurate and rapid recording of the shrinkage of foliage, and by means of it the accompanying outlines (Plate 184) are obtained and figures deduced below.

Fresh leaves were measured by securing sun prints as soon as convenient after being gathered. They were then put in press and dried in the ordinary way for making herbarium specimens. After they were fully dried, a second print was taken or the leaf itself used, and from these two measurements the comparisons are made. It is, of course, an easy matter to take a print each day up to the time the leaf is dry, and in that way determine when in the period of drying that the greater shrinkage takes place.

In order to determine what portion of the leaf surface underwent the more contraction, many of the samples of leaves were first brought with the surface upon a "card" used by hostlers in combing the manes of their animals. In this way small holes practically equidistant were made in the blade, and by means of these, the central ones being taken as fixed points, the shrinkage for all surrounding areas is determined.

The leaves of endogenous plants shrink less than those of the exogens and very little in length. Thus a leaf three inches long of a cultivated cypridpedium gathered in its full vigor loses but a small fraction of an inch in its length, and the same is true of fresh green leaves of a grass (*Panicum*) shown at *a*, while a five inch long leaf of lily-of-the-valley (*b*) shrunk largely in width, but almost none in length. But a somewhat similar leaf (*Helianthus*), as to shape and total area, shrank greatly in all directions and lost 27 per cent. of its original surface. The common plantain (*Plantago major*) bears a large leaf which exhibited a striking amount of shrinkage, as shown by the outlines of the fresh and dried leaf at *c*. The amount of loss in this instance was 44 per cent. At *d* is shown in its two dimensions a hollyhock leaf, this being of the palmate type. This leaf was while fresh punctured in a manner previously described, and the inner line shows how nearly equal the shrinkage was upon all sides. In the center of the lower portion of the plate is the outline of a fresh leaf of the purslane (*Portulacca oleracea*), and within it the same when dried. This is a leaf with very little framework.

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* Read before Section G., A. A. A. S., Madison, Wis., August, 1893.

A most striking example of shrinkage is seen in the outlines for a catalpa leaf shown at *f*; however, this leaf was gathered before it had reached its full size; its loss was 45 per cent. At *g* is shown a grape leaf, and one of an abutelon at *h*.

The following table gives the per cent. of shrinkage of several kinds of leaves examined:

ENDOGENS.	
Pontederia, . . .	11 per cent.
Lily-of-the-Valley,	14 " "
Orchid, ...	19 " "
Panic grass, . . .	27 " "
Average, ...	18 per cent.

EXOGENS.	
Hollyhock, ...	21 per cent.
Maple, ...	22 " "
Smartweed, ...	23 " "
Helianthus, . . .	27 " "
Purslane, ...	35 " "
Plantain, ...	44 " "
Catalpa, ...	45 " "
Average, ...	31 per cent.

The average for the two groups is almost exactly 25 per cent., or in other words a loss by shrinkage in the drying of foliage of one-fourth the original size.

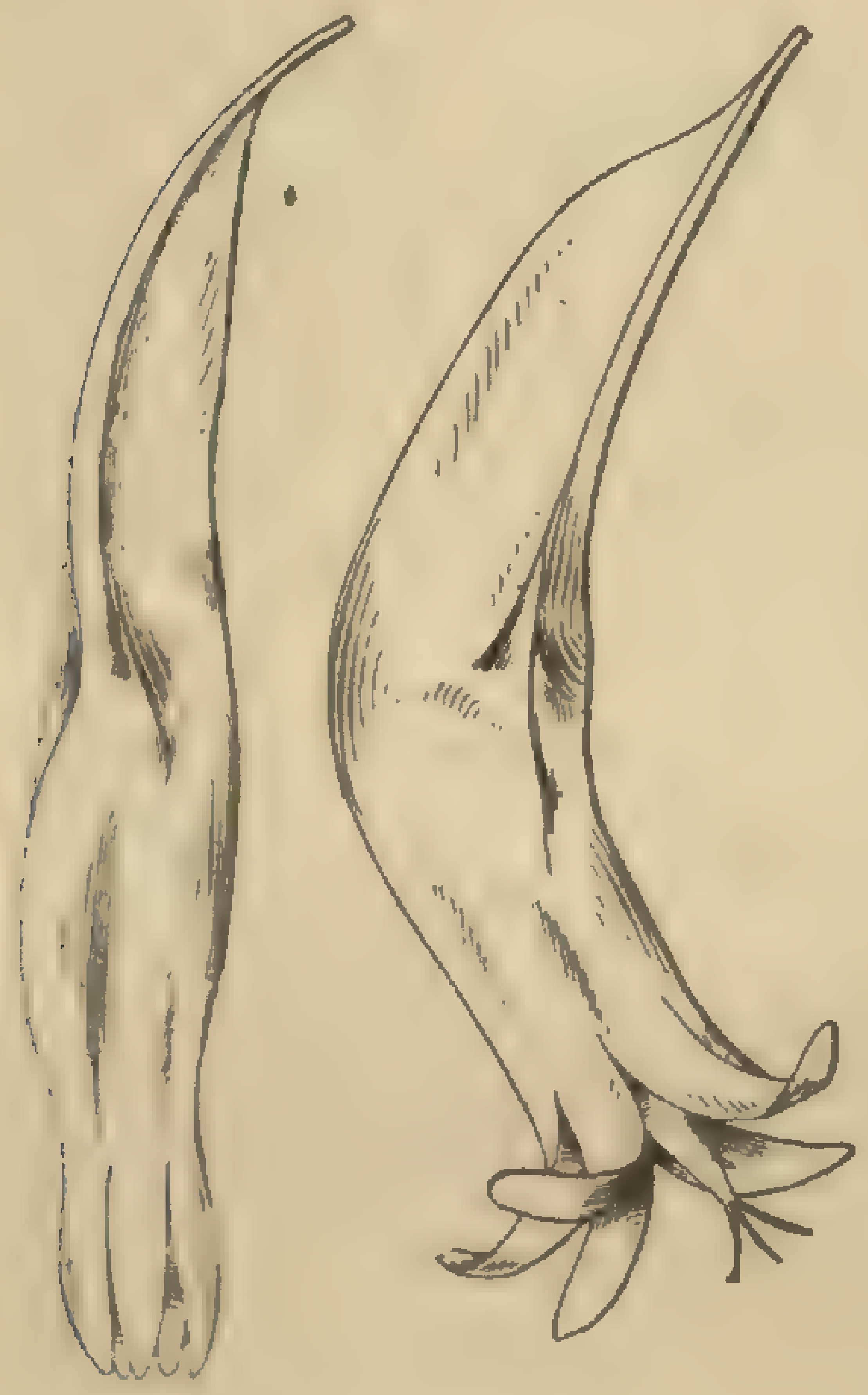
There are many reasons why types of plants should be seen by all monographers, but if types are so essential the writer, in view of the above facts, would plead for a sight of the fresh plants whenever possible. It is fortunate that descriptions are made in large part from dried specimens, or else the measurements for leaves, if at all precise (as usually they are not), would be uniformly too small for the green foliage.

A study of the outlines thus obtained leads to the conclusion that the greater shrinkage is in those localities containing the fewest veins and ribs. It is possible that there is a law of shrinkage to be expressed in the following terms: Leaves in drying under uniform lateral pressure shrink in all parts around and toward the geographical center of the mass of tissue composing its framework. A more general and condensed form of this law is: Leaves in drying under pressure shrink towards the mass-center of the framework.

BYRON D. HALSTED.

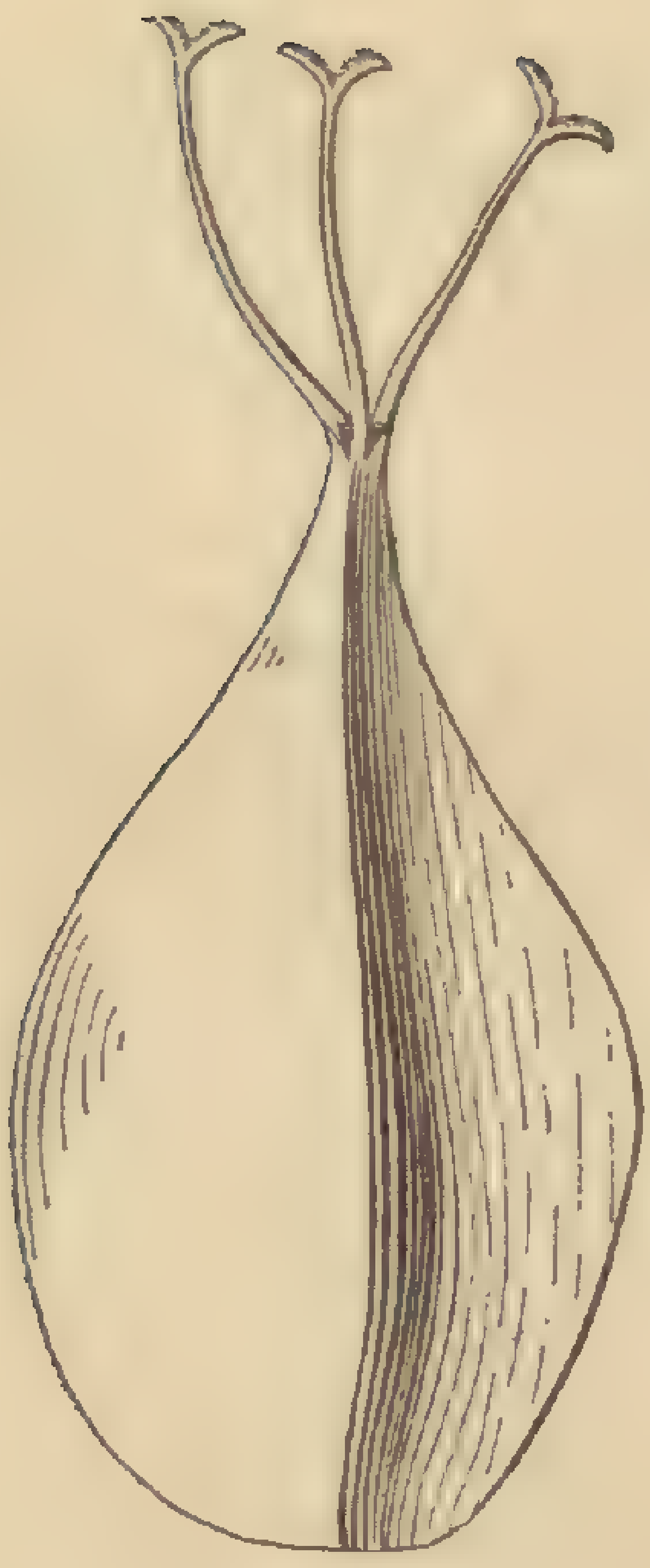
Morphological Notes on the Genus Brunnichia.

The following lines are intended to correct several errors recorded in the works of our leading authorities on genera. Being engaged in a study of some of the Polygonaceæ, the mistakes cited below attracted my attention. They seem to have been made by Endlicher in his Genera Plantarum and are apparently being perpetuated by later writers.



1. *The Calyx of Brunnichia.* Endlicher (Genera Plantarum, 310) says in regard to this: "Perigonium . . . . quinquepartitum, laciniis oblongis . . . . apice conniventibus." According to Bentham and Hooker (Genera Plantarum 3: 103) we should find "Perianthium 5-fidum . . . . lobis conniventibus," while Baillon records this: "Sepala 5, 6, oblonga . . . . circa fructum conniventibus." (Hist. Pl. 11: 393). All these descriptions are given in the place of Bank's original. "Calyx . . . . revolutis." (Gærtn. Fr. et Sem. 1: 214) or some corresponding phrase, which is the correct interpretation of the fact. The figure on Gaertner's table 45 is also correct.

In all probability the error arose by these authors taking their diagnoses from dried or dead specimens. In the living plant the segments of the calyx are revolute or reflexed, and it is only when they die or are dried that the segments converge. However, if soaked in water the calyx-lobes will take their natural position. This I have verified by all the specimens at hand.



2. *The Stigmas of Brunnichia.*—The three authors mentioned above have also given a very misleading interpretation of the stigmas of the genus under consideration. Endlicher (Genera Plantarum, 310) describes them as "Stigmata capitata, emarginata." Bentham and Hooker (Genera Plantarum, **3**: 103) say, "Styli 3 . . . apice capitato-stigmatosi," and Baillon (Hist. Pl. **11**: 393) gives, "Styli ramis 3, apice capitato stigmatoso." Again, these erroneous descriptions have been republished and convey a wrong idea. Here, too, Banks was correct in saying (Gærtn. Fr. et Sem. **1**: 214), "Stigmatibus bifidis." This is the right interpretation, as the stigmas are simply two-cleft, a fact brought out by even a casual examination. This, too, I have confirmed by an examination of the specimens in the Columbia College Herbarium.

The accompanying figures explain themselves.

JOHN K. SMALL.

Proceedings of the Club.

WEDNESDAY EVENING, JANUARY 31ST, 1894.

The Rev. Mr. Lighthipe in the chair and thirty-five persons present.

Mr. Charles L. Pollard, of New York, and Mr. Morris E. Leeds, of Philadelphia, were elected active members.

Upon motion by Dr. Rusby, the Section on Cryptogams, Committee on Local Flora, was requested to devise and submit to the Club a plan for the preparation of a check-list of North American Cryptogams, similar to that on Phanerogams authorized by the Rochester meeting of the A. A. A. S., and based upon the same rules of nomenclature, together with an estimate of the cost of the same.

The regular paper of the evening was then presented by Miss Marion McEwen, entitled "The Comparative Anatomy of *Corema Conradii* and *Corema alba.*" The paper was illustrated by drawings and specimens. The history and distribution of the genera and species of Empetraceæ and the morphological relations of the *Coremas* were briefly presented, and the general anatomical characters of the leaves and stems of the latter described and contrasted. The chief object of the study was to determine the generic and specific relationship of the two, and the conclusion was reached that they were distinct species of one genus. Incidentally, their anatomical relations with the Ericaceæ were pointed out.

Dr. Britton discussed the distribution of the order and remarked that it indicated generic differences in the two species, but considered that the results of Miss McEwen's studies disproved this theory.

Dr. Britton presented a small trunk of *Zanthoxylum Clava-Herculis* L. and remarked upon its peculiar corky spine-bases and its similarity to and confusion (as to common name) with *Aralia spinosa* L. Dr. Rusby remarked that an anatomical study of the barks had led the late Prof. John M. Maisch to the conclusion that there was not a specific identity between the plants called *Z. Clava-Herculis* of the Southern United States and of the West Indies, a conclusion afterward confirmed by systematic botanists. Miss Gregory remarked that the age of the tree could be determined from a section of the corky cushions as well as by counting its annual rings.

TUESDAY EVENING, FEBRUARY 13TH, 1894.

The President in the chair and seventeen persons present.

A letter was received from Mrs. Lydia D. Pychowska, describing the formation of large ice crystals in late autumn on stems of the scarlet Mexican *Salvia.* Dr. Britton remarked on similar phenomena observed by Prof. Lester F. Ward in *Cunila*, and Mr. Kearney stated that Elliott has recorded them in *Pluchea.* Their frequent occurrence in *Helianthenum* is well known.

The following papers were read:

"A Review of the Fossil *Salvanias* with Description of a new

Species from the Laramie Formation of Washington," by Mr. Arthur Hollick. The paper was illustrated by drawings and specimens, and will be published in a subsequeut issue of the BULLETIN.

"Observations on the early Stages of the Formation of the Lichen Thallus," by Dr. Carlton C. Curtiss, illustrated by drawings.

"Some new or little known Plants of the Southern United States," by Mr. T. H. Kearney, Jr., illustrated by specimens (to be published in a subsequent issue of the BULLETIN).

"The Floral Morphology of *Brunnichia*," by Mr. John K. Small, illustrated by specimens and drawings (published in the present issue of the BULLETIN).

Index to Recent Literature relating to American Botany.

Baker, Edmund G. Supplement to Synopsis of Malveæ. Journ. Bot. **32**: 35–38. F. 1894.

Baker, J. G. *Dyckia Desmetiana.* Curt. Bot. Mag. *t. 7340.* F. 1894.

Bicknell, E. P. *Ranunculus micranthus* Nutt. Bull. Torr. Bot. Club, **21**: 41, 42. 25 Ja. 1894.

Maintains the specific identity of this plant, contrasting it with *R. abortivus.*

Bioletti, F. T. An Experience in Herbarium making. Erythea, **2**: 31–34. 9 F. 1894.

Blodgett, Frederick H. On the Development of the Bulb of the Adder's tongue. Bot. Gaz. **19**: 61–65, *pl. 7, 8.* 16 F. 1894.

Account of *Erythonium Americanum.*

Britton, Elizabeth G. Contributions to American Bryology—IV.—Notes on the North American Species of *Orthotrichum*—II. Bull. Torr. Bot. Club, **21**: 1–15. 25 Ja. 1894.

Notes on the species with immersed stomata.

Britton, N. L. New or noteworthy North American Phanerogams—VIII. Bull. Torr. Bot. Club, **21**: 27–34, *pl. 173.* 25 Ja. 1894.

Notes on various species; synopsis of N. A. species of *Stenophyllus;* describes *Galium Oreganum* n. sp.; proposes *Meehania* n. gen. for *Dracocephalum cordatum* Nutt.

Clute, W. N. Late-blooming Trees. Science, **23**: 49. 1894.

Coville, Frederick Vernon. The genus *Hemicarpha* in North America. Bull. Torr. Bot. Club, **21**: 34–37. 25 Ja. 1894.

Describes the two species *H. micrantha* and *H. occidentalis,* and *H. micrantha aristulata* n. var.

Davidson, Anstruther. Californian Field Notes—II. Erythea, **2**: 27–30. 9 F. 1894.

Notes on *Calochortus* and new records for Catalina Island.

Durand, Elias J. *Buxbaumia indusiata* Bridel in Central New York. Bull. Torr. Bot. Club, **21**: 38, 39, *figs*. 25 Ja. 1894.

Ellis, J. B. and **Everhart, B. M.** New West American Fungi. Erythea, **2**: 17–27. 9 F 1894.

Describes 29 species of Pyrenomycetes and Fungi imperfecti from Kansas and California.

Fritsch, Karl. Ueber einige *Licania*-Arten. Oesterr. Bot. Zeitschrift, No. 1. 1894 (reprint).

Description of *Licania subcordata* from Brazil.

Greene, Edward L. Manual of the Botany of the Region of San Francisco Bay. 8vo. pp. 328, San Francisco. 2 F. 1894.

A descriptive flora of the region.

Hallock. N. Sassafras trees. Science, **23**: 51. 1894.

Halsted, Byron D. The Mint Rust upon the Variegated Balm. Bull. Torr. Bot. Club, **21**: 40–41. 25 Ja. 1894.

Notes occurrence of *Puccinia Menthæ* on *Melissa officinalis.*

Heller, A. A. Plants from Virginia new to Gray's Manual Range, with notes on other Species. Bull. Torr. Bot. Club, **21**: 21–27. 25 Ja. 1894.

Notes on various species: *Pentstemon Smallii* n. sp. described.

Hooker, J. D. *Pentarhaphia longiflora.* Curt. Bot. Mag. *t. 7339*. F. 1894.

Jack, J. B. *Stephaniella paraphyllma* Jack, nov. gen. Hepaticarum. Hedwigia, **33**: 11–14, *figs. 1–8*. 30 Ja. 1894.

From Cienega, in Argentino-Bolivian Alps.

James, Jos. F. Fungi and Insects. Science, **23**: 52. 1894.

Jenman, J. S. *Nephrodium (Eunephrodium) bibrachiatum.* Gard. Chron. **15**: 230. 24 F. 1894.

Description of a new fern from the island of Jamaica.

Jenman, J. S. *Nephrodium (Lastrea) Grenadense.* Gardn. Chron. **15**: 198. 17 F. 1894.

Description of a new fern from Grenada, W. I.

Johnson, L. N. On some species of *Micrasterias.* Bot. Gaz. **19**: 56–60, *pl. 6*. 16 F. 1894.

Notes on *M. foliacea*, *M. pinnatifida* and *M. furcata* with which *M. pseudofurcata* Wolle is united.

Mabry, T. O. A Curiosity in the Vegetable World. Science, **23**: 47. 1894.

Meehan, T. *Mertensia Virginica.* Meehans' Month. **4**: 33, *pl. 3.* Mr. 1894.

Parish, S. B. Trees of Southern California. Zoë, **4**: 332–353. 6 F. 1894 (reprint).

Renauld, F., and **Cardot, J.** Mousses Nouvelles de l'Herbier Boissier. Bull. Herb. Boiss. **2**: 32. Ja. 1894.

Description of *Hypnum* (*Harpidium*) *Barbeyi*, a new species from La Paz, Bolivia.

Sargent, C. S. *Darbya umbellata.* Gard. and For. **7**: 74, *fig. 16.* 21 F. 1894.

Sargent, C. S., Editor. A fastigiate Sugar-Maple. Gard. and For. **7**: 65, *fig. 12.* 14 F. 1894.

Sargent, C. S., Editor. The Pride of China tree. Gard. and For. **7**: 92. 7 Ma. 1894.

With illustration of *Melia Azedarach umbraculifera* in Riverside, California.

Schrenk, Hermann. Parasitism of *Epiphegus Virginiana.* Proc. Am. Micros. Soc. **15**: 91–128, *pl. 1–10.* 1894 (reprint).

Scribner, F. Lamson. Two new Grasses. Bull. Torr. Bot. Club, **21**: 37–38. 25 Ja. 1894.

Describes *Panicularia laxa* from Maine and *Poa Chapmaniana* from Missouri, Tennessee and Florida.

Small, John K. Studies in the Botany of the Southeastern United States—I. Bull. Torr. Bot. Club, **21**: 15–20, *pl. 170, 171.* 25 Ja. 1894.

Notes on various Spermatophytes. Describes and figures *Amorpha virgata* n. sp. and *Hieracium Scribneri* n. sp.

Stephani, F. Hepaticarum species novæ—V. Hedwigia, **33**: 1–10. 30 Ja. 1894.

Describes 10 new species and *Delavayella* n. g. *Fossombronia lamellata* n. sp. from Buenos Ayres is the only American species.

Thaxter, Roland. Contributions from the Cryptogamic Laboratory of Harvard University, XXII.—Observations on the genus *Nægelia* of Reinsch. Bot. Gaz. **19**: 49–55, *pl. 5.* 16 F. 1894.

Notes on *Sapromyces Reinschii* (Schroet.) Fritsch, from Maine.

Toumey, J. W. The gradual Disappearance of the Range Grasses of the West. Science, **22**: 9. Ja. 1894.

Erroneously printed **Tourney, I. W.** in February BULLETIN, owing to misprint in original.

Contributions from the Herbarium of Columbia College.

[The numbers omitted from this list are out of print.]

No. 4. A List of Plants Collected by Miss Mary B. Croft at San Diego, Texas. By N. L. Britton and H. H. Rusby (1887), . . . 25 cents.

No. 5. New or Noteworthy North American Phanerogams. By N. L. Britton (1888), . . . 25 cents.

No. 6. An Enumeration of the Plants Collected by Dr. H. H. Rusby in South America, 1886–1887. By N. L. Britton. (Twenty-three parts published; not yet completed.)

No. 7. The Genus *Hicoria* of Rafinesque. By N. L. Britton (1888), . 25 cents.

No. 8. A Recent Discovery of Hybrid Oaks on Staten Island. By Arthur Hollick. (1888), . . . 25 cents.

No. 9. A List of Plants Collected by Dr. E. A. Mearns at Fort Verde and in the Mogollon and San Francisco Mountains, Arizona, 1884–1888. By N. L Britton.

The General Floral Characters of the San Francisco and Mogollon Mountains and the Adjacent Region. By H. H. Rusby (1888), . . . 25 cents.

No. 11. Preliminary Notes on the North American Species of the Genus *Tissa*, Adans. By N. L. Britton (1889), . . . 25 cents.

No. 12. The Genus *Eleocharis* in North America. By N. L. Britton (1889), 25 cents.

No. 13. New or Noteworthy North American Phanerogams, II. By N. L. Britton 1889), . . . 25 cents.

No. 14. A List of State and Local Floras of the United States and British America. By N. L. Britton (1890), . . . $1.

No. 15. A Descriptive List of Species of the Genus *Heuchera*. By Wm. E. Wheelock (1890), . . . 25 cents.

No. 16. New or Noteworthy North American Phanerogams, III. By N. L. Britton (1890), . . . 25 cents.

No. 17. The Flora of the Desert of Atacama. By Thos. Morong (1891), . 25 cents.

No. 19. Notes on North American Haloragæ. By Thos. Morong (1891), 25 cents.

No. 20. New or Noteworthy North American Phanerogams, IV. By N. L. Britton. (1891), . . . 25 cents.

No. 21. Notes on the North American Species of Eriocauleæ. By Thos. Morong (1891), . . . 25 cents.

No. 22. New or Noteworthy North American Phanerogams, V. By N. L. Britton (1891), . . . 25 cents.

No. 23. The American Species of the Genus *Anemone* and the Genera which have been referred to it. By N. L. Britton (1891), . . . 25 cents.

No. 24. Review of the North American Species of the Genus *Xyris*. By Heinrich Ries (1892), . . . 25 cents.

No. 25. A Preliminary List of the Species of the Genus *Meibomia* occurring in the United States and British America. By Anna M. Vail (1892), . 25 cents.

No. 26. A List of Species of the Genera *Scirpus* and *Rynchospora* occurring in North America. By N. L. Britton (1892), . . . 25 cents.

No. 27. Note on a Collection of Tertiary Fossil Plants from Potosi, Bolivia. By N. L. Britton (1892), . . . 25 cents.

No. 28. The Anatomy of the Stem of *Wistaria Sinensis.* By Carlton C. Curtiss (1892), . . . 25 cents.

No. 29. New or Noteworthy North American Phanerogams, VI. By N. L. Britton (1892), . . . 25 cents.

No. 30. *Ranunculus repens* and its Eastern North American Allies. By N. L. Britton (1892), . . . 25 cents.

No. 31. A Preliminary List of American Species of *Polygonum.* By John K. Small. (1892), . . . 25 cents.

No. 33. A New Species of *Listera*, with Notes on Other Orchids. By Thos. Morong (1893), . . . 25 cents.

No. 34. The North American Species of *Lespedeza.* By N. L. Britton (1893), 25 cents.

No. 35. An Enumeration of the Plants Collected by Dr. Thos. Morong in Paraguay 1888–1890. By Thomas Morong and N. L. Britton, with the assistance of Miss Anna Murray Vail (1892–1893), . . . $1.50

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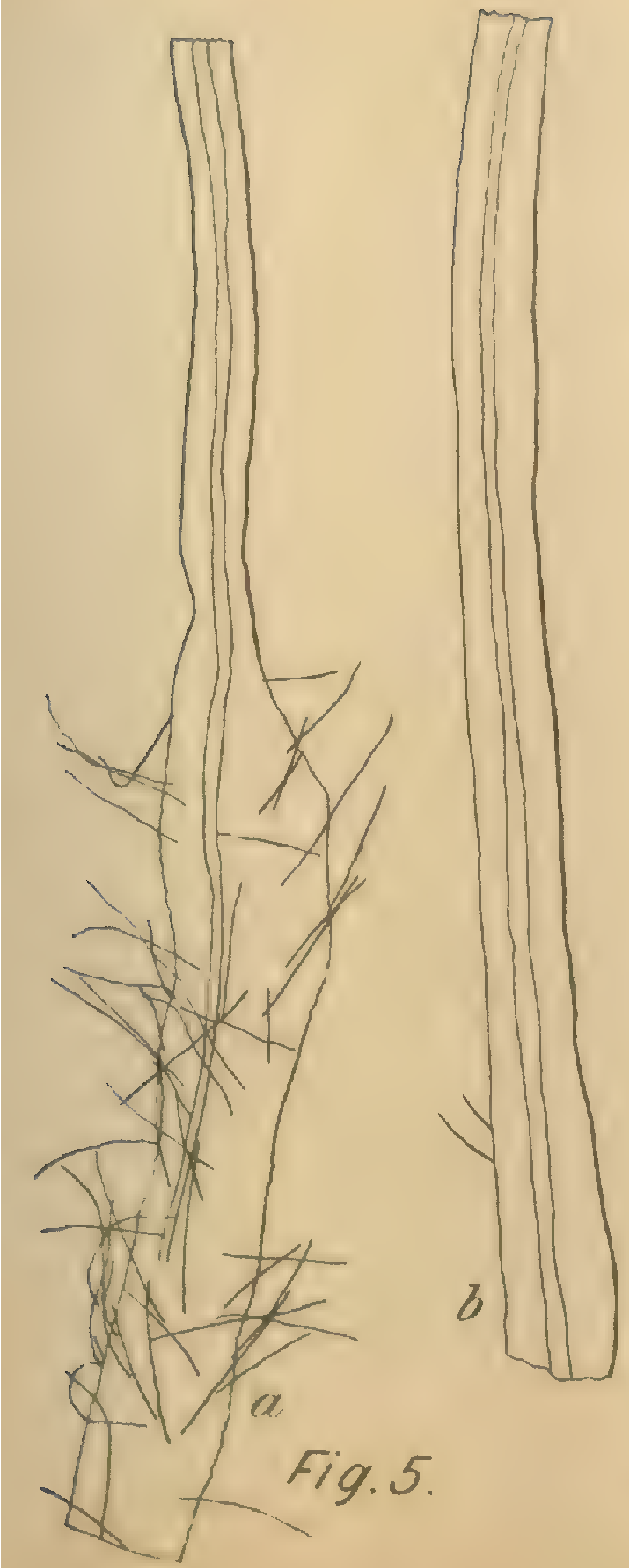
STAMENS AND STYLES OF LONICERA.



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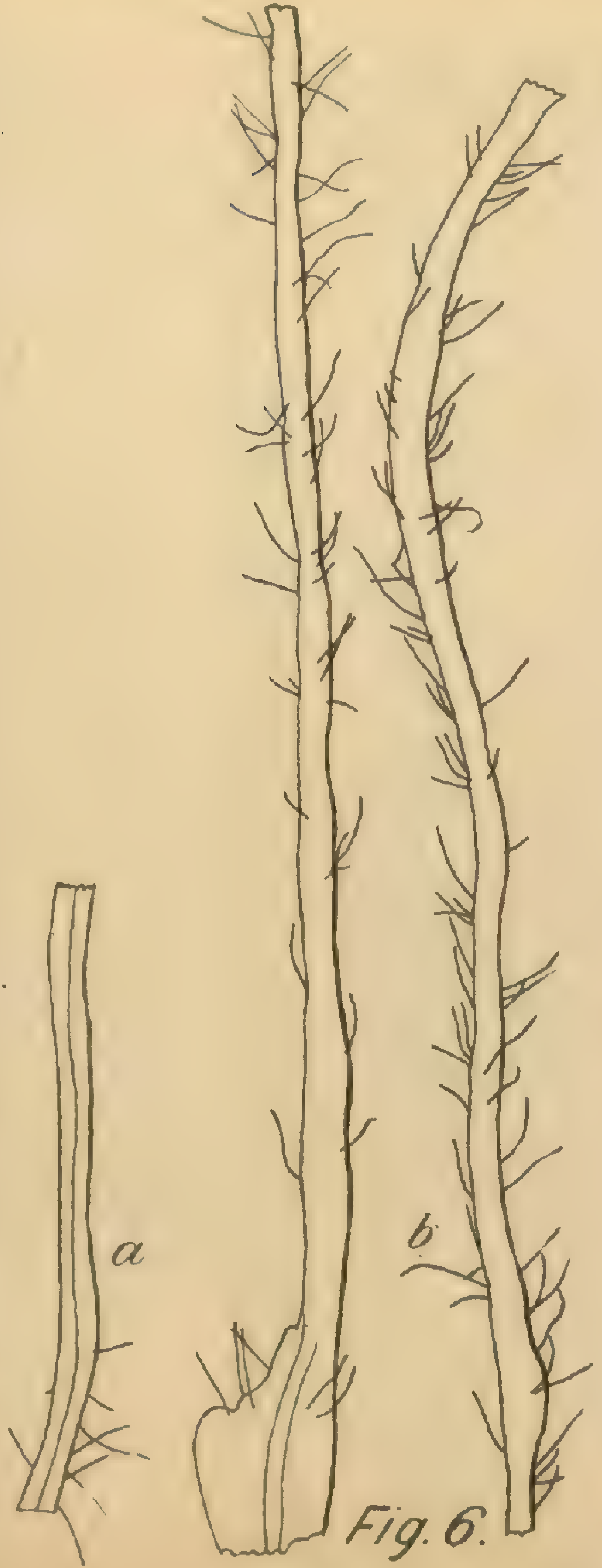

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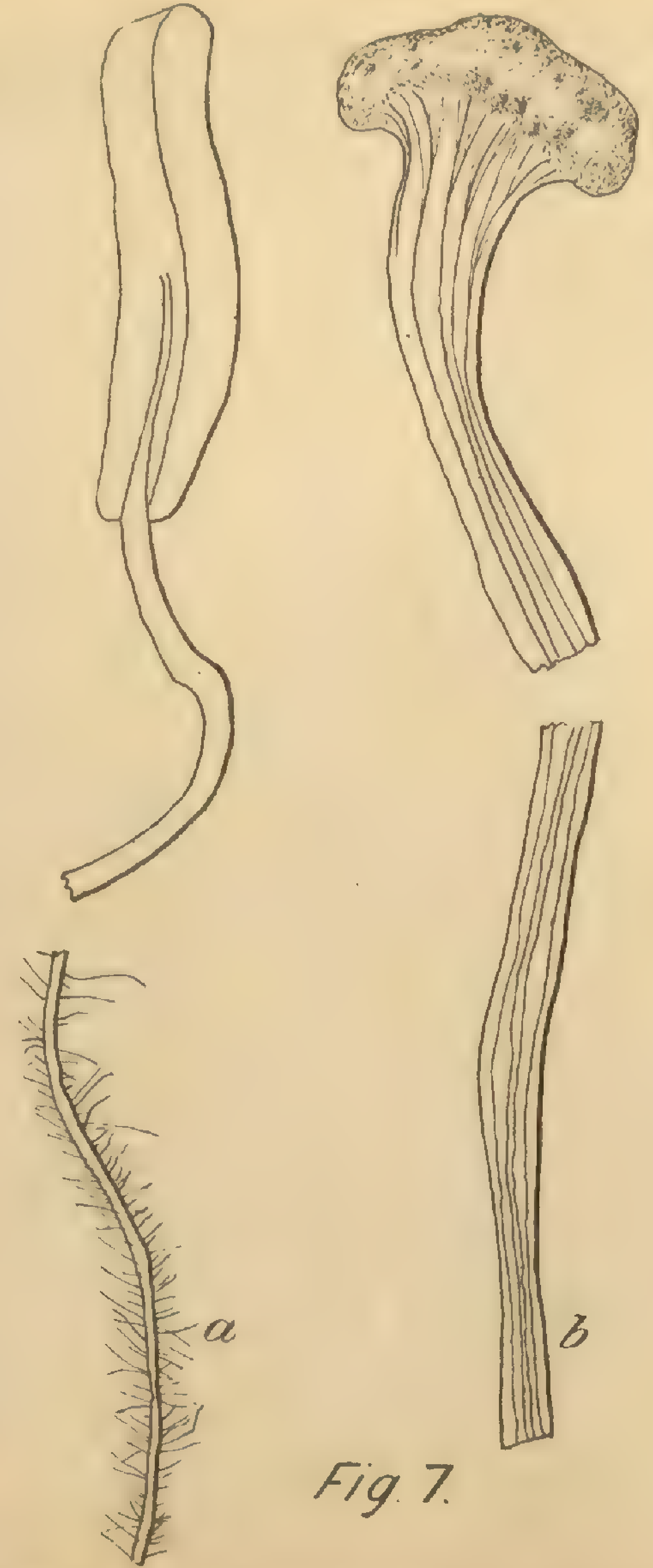

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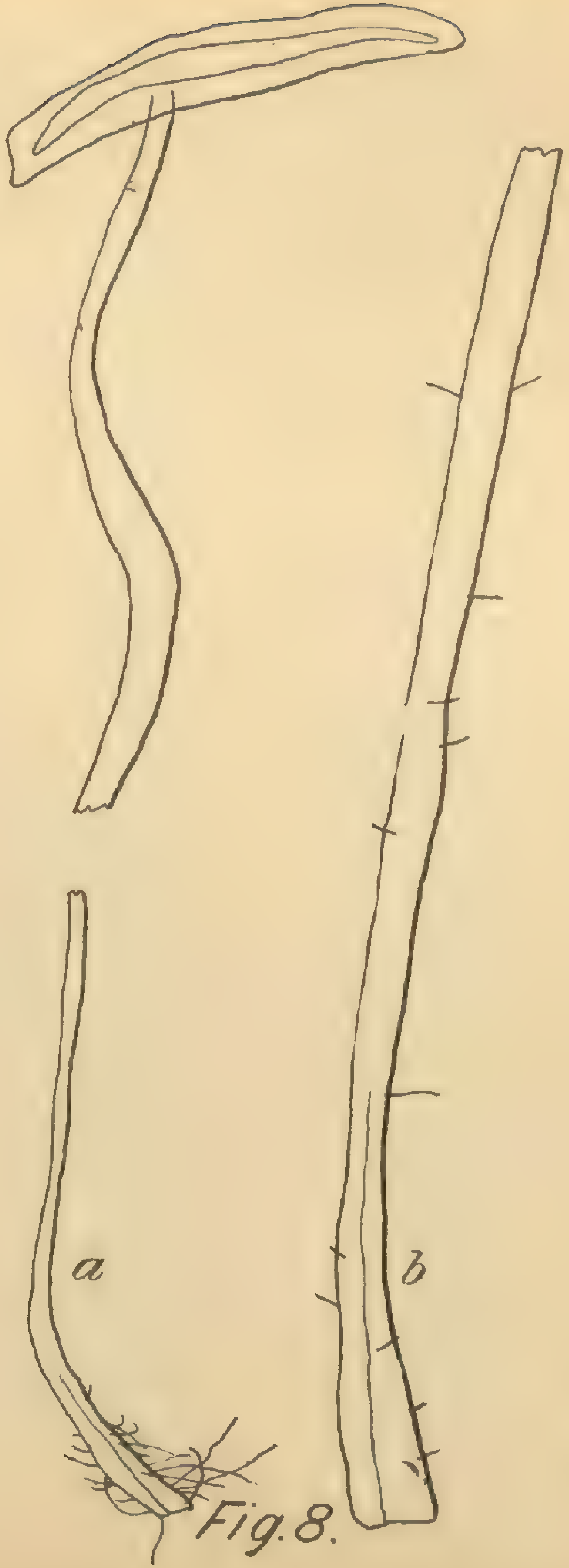

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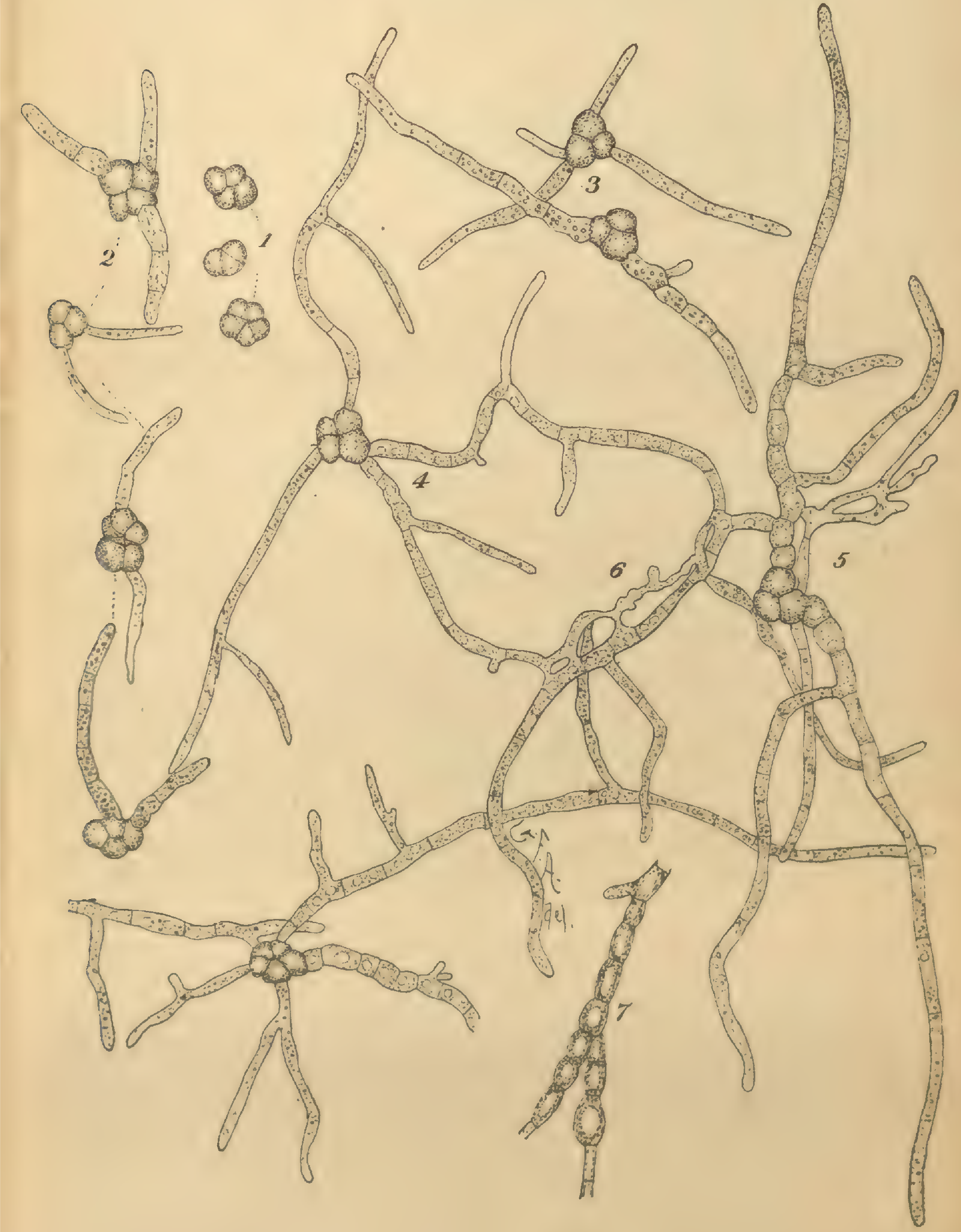
STAMENS AND STYLES OF LONICERA.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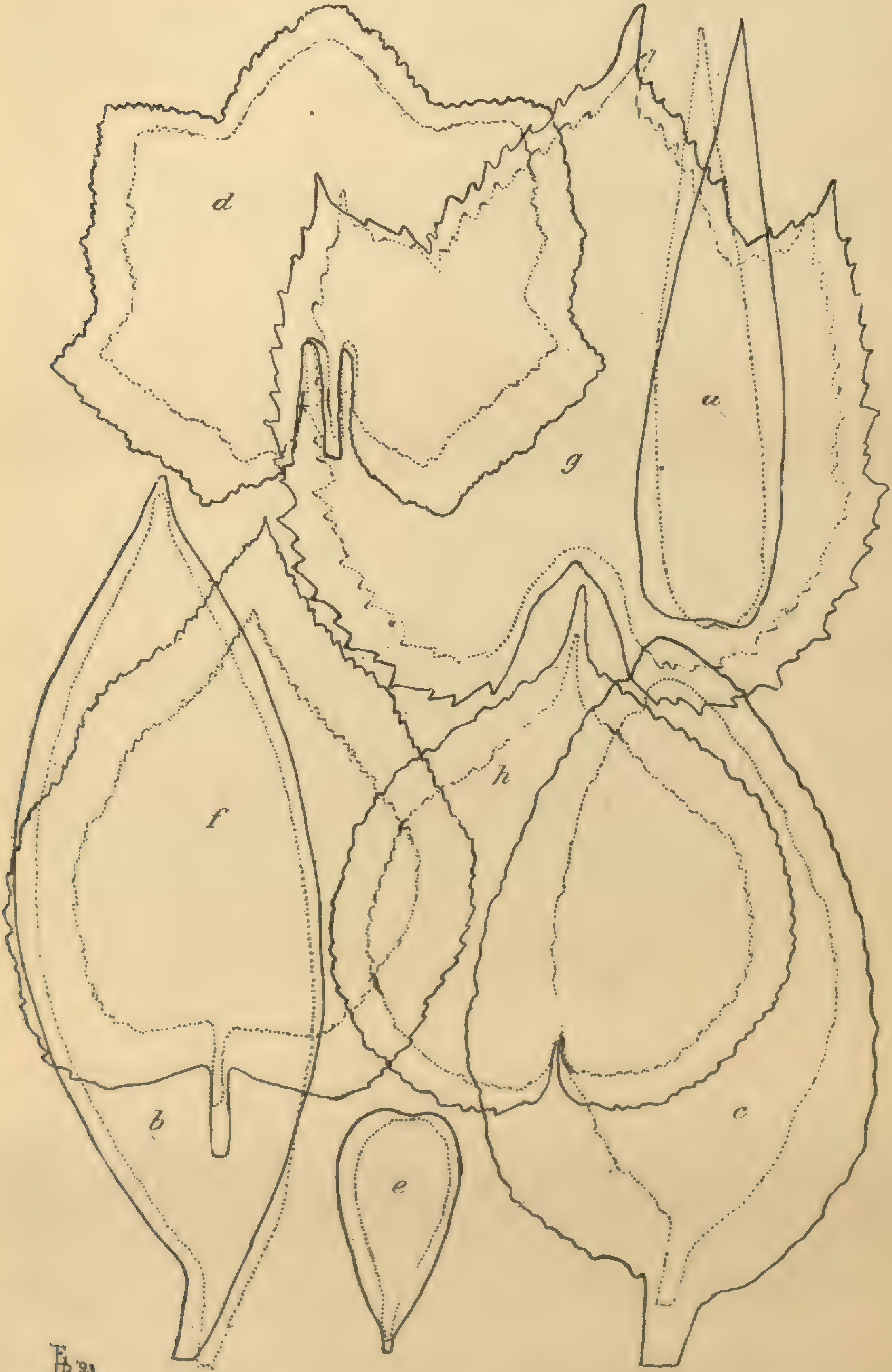
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VOL. 21. APRIL, 1894. NO. 4.

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OF THE

TORREY BOTANICAL CLUB.

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EDITED BY

NATHANIEL LORD BRITTON,

AND OTHER MEMBERS OF THE CLUB.

CONTENTS:

PAGE.

Contributions to American Bryology—VI. Western Species of *Orthotrichum*. Supplementary Note on the North American Species of *Weissia*: *Elizabeth G. Britton* 137

New Piperaceæ from Bolivia: *C. De Candolle* 160

Remarks on *Chara gymnopus* A. Br., with Descriptions of new Species of *Chara* and *Nitella* (PLATES 185–192): *T. F. Allen* . 162

New and interesting Species of *Polygonum* (PLATES 193–196): *John K. Small* . . . 168

The Nomenclature of the Genus *Buttneria* Duham.: *T. H. Kearney, Jr.* 173

BOTANICAL NOTES.—The Herbarium of the late Isaac C. Martindale; New Plants in the Cayuga Flora: *Karl M. Wiegand*; Notes and Queries: *C. O. Thurston*; *Scutellaria resinosa* Torr.: *Thos C. Porter* 176

REVIEWS AND NOTES ON LITERATURE.—The Study of the Biology of Ferns by the Collodian Method; Manual of the Botany of the Region of San Francisco Bay; *Juncus marginatus* and its Varieties; Annual Reports of the State Botanist of the State of New York; New Gentians 178

PROCEEDINGS OF THE CLUB 182

INDEX TO RECENT LITERATURE RELATING TO AMERICAN BOTANY 184

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LANCASTER, PA.

BULLETIN

OF THE

TORREY BOTANICAL CLUB.

Vol. 21. Lancaster, Pa., April 25, 1894. No. 4.

Contributions to American Bryology—VI.

By Elizabeth G. Britton.

I. WESTERN SPECIES OF ORTHOTRICHUM.

In a recent letter Dr. Venturi says that "there is great confusion in the genus *Orthotrichum*, due to the fact that American authors have described many new species, and that European authors have described others without taking into account what had already been done in America."

Even a superficial survey of the field will convince us that this is only too true, but we think European bryologists are more accountable for this than American ones, for Sullivant at least, who described most of our new species, figured and gave complete characterizations of all which he proposed.

Since 1887 there have been added 14 species and 8 varieties of this genus to the flora of our Western States; 9 of these are new, and 5 others are previously described European ones. There were 5 new species added by Mitten in 1865, which were but little known and several not since collected, and in 1874 Sullivant figured and described 8 more. With the recent additions in the Botanisches Centralblatt, and Hedwigia, by Venturi; and Kindberg's and Müller's from Macoun's Canadian mosses, with a few of Renauld and Cardot's from Henderson's Oregon collections, it brings the number up to 47, many of which have been collected only once, and are still lacking in figures and parts of descriptions. It seemed desirable, therefore, to call the attention of students and collectors in our Western States to this fact; to give in each case the exact localities where the types were collected, and to solicit more material, in order to enable us to arrive at some satisfactory conclusion in the future. To facilitate the better understanding of these species, they have been divided into groups, 5 with superficial stomata and 7 with immersed. Some of the species are referred with some doubt to these groups, and will probably have to be transferred when better understood. We have to thank Dr. Venturi for his valuable assistance, and M. J. Cardot and Prof. Macoun for the receipt of portions of types from their herbaria.

SECTION A. Those with superficial stomata.

I. GROUP OF ORTHOTRICHUM RUPESTRE.

This is entirely a Western group, none of the members of it having been collected east of the Rocky Mountains and Texas. To this group belong five species and several varieties, enumerated below. Rock species with short immersed capsules, with 8 distinct ridges, 16 erect teeth and 8 cilia. Calyptra hairy.

1. ORTHOTRICHUM RUPESTRE Schleich. Crypt. Helv. Ex. No. 24 (1806).

This species needs further study. Mr. Leiberg says that he meets with very puzzling variations, and his collections show a great diversity of forms, all within certain well-defined limits, however. As there have been five European varieties described by Venturi, only one of which is reported as American, it would seem as if critical work on this species would repay study. A recent paper in the Revue Bryologique, 58 (1893), states that this species, as well as *O. Sturmii* in Europe, has a preperistome as in the other group of rock species with immersed stomata.

Type specimen European. American specimens so named are distributed from the Rocky Mountains west to the Pacific Coast. Reported from California, Oregon, Nevada, Idaho and Colorado.

2. ORTHOTRICHUM STURMII Hoppe and Hornsch. Regensb. Flora, 89 (1819). Sull. Mosses U. S. 33 (1856), L. & J. Man. 166 (1884).

This species is very close to the above, and is separable from it only by its denser bistromatic leaves and the abrupt base of the capsules. Venturi considers it scarcely distinct enough to be a species.

Type European. It has been reported from California, Nevada, Oregon, Colorado, through the Rocky Mountains north to British Columbia; also in Texas and New Mexico, collected by Wright.

3. ORTHOTRICHUM SHAWII Wilson; Br. & Sch. Br. Eu. Supp. fasc. 1–2 (1864). Philibert, Rev. Bryol. 9: 9 (1882).

Differs from the first two species by having no cilia, and the capsules are only faintly striate above and below when old.

Type rare; has only been collected in one locality in England. We have specimens collected by Bolander, which have been submitted to Venturi and referred to this species with some doubt from the description in Braithwaite's British Mosses.

4. ORTHOTRICHUM BOLANDERI Sull. Icon. Suppl. 64, *t. 46* (1874).

Sullivant says that this is a very distinct species related to *O. rupestre* and *O. Sturmii*, but differing in the markings of the teeth, the longer, cylindric capsule and the bistromatic cells of the leaves. In February, 1890, Dr. Watson sent me a portion of this type. It is remarkable for its dense black stems and closely appressed and crowded leaves. We also have specimens from the Department of Agriculture, received November, 1890, from Bolander's duplicates, which agree with the types of this species.

The figures in Sullivant's Icones represent the capsules longer and more cylindric than the types. The capsules are not more than a third longer than broad, 1.5 by 1 mm., and less exserted than figured, and the teeth are more papillose than the cilia with more trabeculate joints.

They were compared with Mougeot and Nestler's *O. rupestre* in the Jaeger Herbarium "e manu Schimper," and I find the markings of the teeth are quite distinct, as Sullivant stated. If the European species is as variable as Dr. Venturi states, having the teeth either striolate or papillose, these might be included in that species, but with modern splitting tendencies, I think this species will stand.

Venturi classes it as *O. rupestre* var. *vulgare* (Musc. Gall. 156, 1887).

Type locality "Oakland Hills, on boulders," California, Bolander, October, 1868. Not since reported.

5. ORTHOTRICHUM TEXANUM Sull. Mosses U. S. 33 (1856). Icon. Musc. 53, *t. 34* (1864).

According to Sullivant l. c. this species "differs from *O. Sturmii* in the larger size of the plants, longer, more acuminate leaves and double peristome."

Type locality, "Texas, Wright; Santa Fé, New Mexico, Fendler." Also California, Bolander, north to Vancouver and British Columbia, east to Idaho and Colorado.

Var. *globosum* Lesq. Mem. Cal. Acad. **1**: 17 (1868).

We have a fragment of this variety from the type specimen, and have examined the capsules. They are short, immersed or only partly exserted, globose pyriform, with a tapering neck, peristome single, teeth pale, smooth or with faint traces of thickening ridges as in *O. bullatum*, but not papillose. The spores are small, .016–.018 mm., warty and brown and the calyptra sparsely hairy. Our capsules are too young to show the ridges of the walls, the cells being still full of chlorophyll, though the spores are ripe. It would seem as if the thickening of the teeth and the ridges of the capsules were a later development.

Type locality, "Nevada Falls, Yosemite, California, Bolander." Also reported in Macoun's Catalogue from Agassiz and Yale, British Columbia; specimens not seen.

6. ORTHOTRICHUM DOUGLASII Duby, Mem. Soc. Phys. d'Hist. Nat. Geneva (1868), Bull Torr. Bot. Club, **20**: 400 (1893).

This species has already been described from the types in a recent number of the BULLETIN. The type is immature, though sufficiently developed to refer specimens to it.

Type locality, Columbia River, Douglas; Idaho, Sandberg and Leiberg.

7. ORTHOTRICHUM BULLATUM CM. Flora, **70**: 223 (1887).

Type locality, Napa Soda Springs, California, May, 1886, Martha R. Mann. A portion of the type specimen was sent me by Miss Clara E. Cummings, in January, 1891, with a copy of the original description. They agree, but the stomata are not mentioned. They are superficial around the middle of the capsules; nor the spores, which are rough with warts, and .013–.018 mm.; the cells around the mouth are densely thickened, with a projecting annulus; the teeth are slender and thickened with coarse sinuous ridges, and the plants are 5 cm. high and very slender and flexuose. They are what we have been calling *O. Texanum*, without any inner cilia. Specimens collected by J. B. Leiberg, No. 134, sent to Dr. Venturi, were named by him *O. rupestre*. They seem to be the form figured in the Bryologia Europæa *t. 217* as var. γ. *U. Sehlmeyeri* Hornsch. None of the European specimens in the Jaeger herbarium are as slender or branching, all are more rigid, and I am inclined to think they show the same divergence from *O. rupestre* that *O. papillosum* does from *O. Lyellii.*

It will be remembered that in the Icones, Sullivant figured *O. Texanum* without cilia, but in the description he says they are present, but more or less rudimentary. It will also be remembered that the localities cited in the mosses of the United States are Texas, Wright; Santa Fe, New Mexico, Fendler, and that later in the Icones he added California, Bolander. The specimens distributed as No. 187 of S. & L. Musci, Bor. Am. Ed. 2, are from Texas. They are rather unsatisfactory, and I find them just as imperfect both in Prof. Eaton's set and in Sullivant's herbarium at Cambridge, but the description calls for tall lax specimens like these of Miss Mann's.

II. GROUP OF ORTHOTRICHUM SPECIOSUM.

This group includes those species of the genus which have long, cylindric, exserted capsules with very faint ridges or entirely smooth. The teeth in pairs, reflexed or recurved when dry, and the cilia 8, erect. Six species and 5 varieties are here included: *O. speciosum*, *O. elegans*, *O. Killiasii*, *O. lævigatum*, *O. Kingianum* and *O. rhabdophorum*. *O. Rauei* and *O. Hainesiæ* have been described by Austin, but reduced by subsequent authors.

8. ORTHOTRICHUM SPECIOSUM Nees.

This species occurs in the Eastern States from New Jersey to New Hampshire, is very common in Ontario, Quebec and the Eastern Canadian provinces, extending west to Vancouver Island. Type European.

Var. *polyanthum*, Lesqx. Mem. Cal. Acad. Sci. 1: 17 (1868). On rocks, big trees, California, Bolander.

Var. *brevicaule*, Lesqx. Mem. Cal. Acad. Sci. 1: 17 (1868). "Same locality as the former."

Var. *Rauei* (Aust.) L. & J. Man. 169 (1884).

Orthotrichum Rauei Aust. Bull. Torr. Bot. Club, **6**: 343 (1879).

Austin's types have been examined and compared with *O. speciosum.* There scarcely seems any necessity for maintaining this as distinct from var. *polycarpum;* though it antedates the latter. The capsules are numerous, long exserted, and striate at base and apex.

Type locality, Colorado, Brandegee, ex. herb. E. A. Rau.

Var. *polycarpum* L. & J. Man. 169 (1884).

Same locality as var. *Rauei.*

Var. *Roellii* Vent. Bot. Centrb. **44**: 419 (1890). Hedwigia, **32**: 285 (1893).

Plants densely pulvinate, dark green; leaves almost smooth papillæ very minute, cells large, margins revolute; capsule emergent, oblong ovate, smooth, peristome normal.

Argyle, near Chicago, Illinois. Röll.

8a. *Orthotrichum Hainesiæ* Aust. Bull. Torr. Bot. Club, **6**: 342 (1879).

We have examined Austin's type and have compared it with *O. speciosum,* to which it was referred as a form in the Manual. It agrees with that species microscopically, but the plants are dark, depauperate specimens, with spreading leaves, and almost smooth calyptras, and differ in aspect from No. 186 S. & L. Musci Bor. Am. Ed. 2, having the capsules smaller and more immersed. Both plants are from the Rocky Mountains, and grew on rocks.

9. ORTHOTRICHUM ELEGANS Schwaegr.

Differs from *O. speciosum* only in the teeth being reflexed, not revolute when dry, and in the less papillose leaves.

Pend Oreille River, and between that and Kootenay River, British Columbia, Lyall. Also collected by J. B. Leiberg on ledges at Lake Pend d'Oreille, Idaho, May, 1889, No. 9 and 152 in part.

10. ORTHOTRICHUM KILLIASII C. M. Bot. Zeit. 4 (1859).

Venturi considers this only an Alpine variety of *O. speciosum,* differing in its smaller size, denser cushions and shorter leaves.

Growing on rocks in alpine regions. Reported from Disco Island.

11. ORTHOTRICHUM LÆVIGATUM Zett.

Venturi classed this species in the group with *O. rupestre,* in the Muscologia Gallica, but in a recent number of Hedwigia he says that he finds the teeth when dry reflexed as in *O. speciosum,* with which group it is more closely allied by its long cylindric capsule exserted and smooth, or the ridges very short and faint, the teeth united in pairs, and the cilia 8. He states that while it is very rare in Northern Europe, in America it is common, having been collected in many localities by Dr. Röll, and showing several forms. (Hedwigia, **32**: 227, 1893).

It has been collected in the Rocky Mountains, from Nevada, Idaho, Oregon, Washington, to British Columbia.

12. ORTHOTRICHUM RHABDOPHORUM Vent. Bot. Cent. 8 (1890); Hedwigia, **32**: 283 (1893).

It is said to differ from *O. lævigatum* by the ridges being continuous the entire length of the old capsules, while they are fainter in the operculate stage, and the cilia more or less perfect.

Type from Cascades, Thorp, Washington, Röll.

13. ORTHOTRICHUM KINGIANUM Lesqx. Mem. Cal. Acad **1**: 18 (1868); Sull. Icon. Suppl. *74, t. 55* (1874); Bull. Torr. Bot. Club, **20**: 401 (1893).

Since I have seen the types of Dr. Venturi's group of *Orthotrichum stenocarpum,* and compared them with *O. Macounii,* I have found another portion of the type of *O. Kingianum* in Austin's herbarium with *O. Macounii,* and compared it with the species of this section. They have a seta 3–4 mm. long, twice the length of the capsule, and quite exserted with a long vaginule, and the neck tapering into the seta, which is twisted; the capsules are narrowly cylindric when empty, and the central cone of tissue remains as figured in the Icones, figs. 8–11. The teeth are erect, united in pairs as figured, with the segments and thickening ridges very indistinct and uncertain. The cilia, too, are not as clearly developed as the artist has figured them. In Sullivant's type the upper cells of the leaves are large, occasionally .018 mm. in length, with much thickened walls and short blunt papillæ; the lower cells are oblong, longer and smoother, and the basal angles auricled and brown. The vein is thick, deeply channeled, and brown, ending below the apex, the margins are strongly revolute, and the cells appear to be inflated and protruding in the middle part of the leaf. In the light of later study this species seems to be more allied to the group of *O. Macounii* than to that of *O. lævigatum*, and may possibly antedate one of the recent new ones from the Pacific Coast.

Type locality, on rocks, Falls of the Yosemite, Bolander. Kindberg cites Macoun's numbers 240 and 289 as this species, but we have not seen the specimens. It is to be hoped any botanists visiting the Falls of the Yosemite will try to collect this species again.

III. GROUP OF O. MACOUNII.

(Group of *O. stenocarpum* Vent. Hedwigia, **32**: 271, 1893).

Dr. Venturi includes in this group three very closely allied species, *O. stenocarpum*, *O. Roellii* and *O. Schlotthaueri*, which he says form a new type of the genus and a connecting link between *Orthotrichum* and the species of *Ulota* with straight leaves, like *U. Hutchinsiæ*, which they closely resemble in their habitat, dark green dense growth and long exserted capsules. The bell-shaped, entire calyptra differs from that of *Ulota*, however. He enters into a long discussion of generic differences and suggests other lines of classification for the species of these two genera based on the stomata, etc.

14. ORTHOTRICHUM MACOUNII Austin, Bull. Torr. Bot. Club, **6**: 343 (1879). *Orthotrichum stenocarpum* Vent. Bot. Cent. **44**: 389 (1890). Hedwigia **32**: 221 (1893), non Bridel Bryol. Univ. 274 (1826).

Austin's description was published five years before the Manual was issued and listed in Rau and Hervey's Catalogue in 1880, yet it is not to be found in the Manual, nor in Barnes' Key nor in Renauld and Cardot's Catalogue. His species is a good one, represented by fine specimens, and compared critically with authentic specimens of its nearest ally at the time it was published, *O. Kingianum*, to which it is related by its superficial stomata, exserted cylindric capsule, perfectly smooth when dry, with a long tapering neck. The upper cells of the leaves also are large and bluntly papillose as in that species. The following are Austin's remarks on the two species.

"Closely related to *O. Kingianum* Sull., but compared with a specimen from James ex herb., Lesqx., it differs as follows: More robust, leaves less erect, longer, less densely papillose, with the upper cells larger and less granulose, the lower ones much less enlarged and in the older leaves not at all pellucid; capsule paler, narrower, exactly cylindrical when moist, etc. Compared with the description and figures in Icones Suppl. p. 74, t. 55, the leaves are much more acute and of a uniform texture throughout, costa extending nearer the apex; capsule not obovate when moist, the mouth not broader when dry, teeth granulose, straw-colored, not brown."

Through the kindness of Dr. Venturi I have a portion of the type of *O. stenocarpum*. We also have Röll's Number 606 from Roslyn, Washington, and four specimens collected by J. B. Leiberg on granite ledges at Lake Pend d'Oreille, and Rathdrum, which have been named by Dr. Venturi. We have no hesitation in saying that Austin's species antedates Dr. Venturi's, and this latter is doubly debarred by Bridel's name of 1826, of which it is a homonym.

Type locality on rocks, Cascades, British Columbia, Macoun, May 17th, 1875. Also collected by Röll on rocks near Easton, Washington, No. 604; near Rigi, Clear Lake, Washington, 900; Roslyn, 606; Ellensburgh, Thorp, 607, and by J. B. Leiberg near Lake Pend d'Oreille and Rathdrum, Idaho, 1888, Nos. 8 and 11 and 11a.

15. ORTHOTICHUM ROELLII Vent. Bot. Cent. **44**: 416 (1890). Hedwigia, **32**: 216, 222 (1893). *O. lonchothecium* CM. & Kindb. Macoun's Cat. 6, 90 (1892).

There seems to be some doubt to which species Kindberg's should be referred. In his letters Dr. Venturi has said it was the same as *O. stenocarpum*, but in Ren. & Cardot's list it is cited as a synonymn of *O. Roellii.* (Rev. Bryol. **19**: 19, 1892.)

This species has also exserted cylindric capsules with short ridges, erect, striolate not papillose teeth, united in pairs, with a few vestiges of cilia.

Type from rocks at Thorp, near Ellensburgh, Washington, Röll. The localities cited in Macoun's Catalogue for *O. lonchothecium* are both "on trees," Krao Creek, Kootenai Lake, B. C., and at Banff, Rocky Mts., Macoun; though the specimens distributed as No. 497 of Macoun's Canadian mosses labelled *O. lonchothecium* are from "metamorphic rocks" at Deer Park, Lower Arrow Lake, B. C., June 4th, 1890.

16. ORTHOTRICHUM SCHLOTTHAUERI Vent. Bot. Cent. **44**: 416 (1890). Hedwigia, **32**: 216, 223 (1893). Rev. Bryol. **19**: 18 (1892).

This species has exserted cylindric capsules not sulcate, teeth erect, united in pairs, but split nearly to base, papillose; cilia more or less fugacious or deficient.

Type from the Rocky Mountains at Garrison, Montana, Röll, also collected in Sun River Cañon, Montana, by R. S. Williams, No. 97, named by Venturi.

IV. GROUP OF O. AFFINE.

17. ORTHOTRICHUM AFFINE Schrad. Spic. fl. Germ. 67 (1794). Bull. Torr. Bot. Club, **20**: 394 (1893).

This species occurs in the Eastern States, around the Great Lakes, and in the Northeastern provinces of Canada.

Var. *neglectum* (Schimp.) Vent. Musc. Gall. 171 (1887). Specimens collected by J. B. Leiberg at Lake Pend d'Oreille on trees, No. 88, have recently been determined by Dr. Venturi as this variety. It has not been previously reported from North America.

V. GROUP OF O. LYELLII.

In a recent number of the BULLETIN (**20**: 397, 1893) we expressed our views on this group. Dr. Venturi's remarks in Hedwigia, **32**: 273, 286 (1893)) will be found interesting. We have another synonym to add to the ones already enumerated for this species, *O. Menziesii* Mitt. (Journ. Linn. Soc. **8**: 25, 1865).

VI. GROUP OF O. ARCTICUM.

Five species in this group are known to occur in Greenland, and probably in Arctic America. They are characterized by a short pyriform capsule, exserted on a short seta; teeth reflexed in pairs, cilia 8, short triangular or rudimentary. None of the group had been reported from the United States, until Dr. Venturi recently described one.

18. ORTHOTRICHUM PRÆMORSUM Vent. Bot. Cent. **44**: 418 (1890). Hedwigia, **32**: 269, 282 (1893).

Said to be closely allied to *O. Caucasicum* Vent. (Musc. Gall. 176, *t. 48*, 1887). Characterized by its hygroscopic leaves and non-arctic habitat.

Type locality, Yellowstone National Park, Wyoming, Röll.

SECTION B. Those with immersed stomata.

**Brachytrichum*. Capsules with 8–16 striæ, and a more or less developed preperistome.

I. GROUP OF O. CUPULATUM.

Capsules immersed or more or less exserted. Rock species, rarely on trees.

This group has been discussed at length in two previous communications (Bull. Torr. Bot. Club, **20**: 401–404 and **21**: 1–4). It includes 3 species with exserted capsules, *O. anomalum*, *O. saxatile* and *O. nudum*, and four with immersed, *O. cupulatum*, *O. urnigerum*, *O. Porteri* and *O. Lescurii*, of which the two latter have only been found in the Eastern States. Two poorly characterized varieties of *O. anomalum* have been recently added.

19. ORTHOTRICHUM ANOMALUM.

Type European. Occurs in the Eastern States from Pennsylvania to Ontario and the Canadian provinces, west to the Rocky Mountains. Not yet reported from the Pacific slope.

Var. *Americanum* Vent. Macoun's Cat. part **6**: 86 (1892).

Type localities. Distributed in Drummond's Mosses, No. 148. "Hab. upon rocks common," and in Macoun's Canadian Mosses No. 118 in part, on rocks along the shore of Lake Winnepegoosis, Manitoba and on bowlders and sandstone rocks, Hand Hills, Alberta, Macoun.

This is very insufficiently described as "a form that has yellow capsules and differs considerably from the normal one in the well-evolute cilia." I asked Dr. Venturi if it could be referred to *Orthotrichum saxatile* (Lipr.), but he says this is only a variety or even a form of *O. anomalum*, and is not the same as *var. Americanum*. "The characters indicated by Limpricht are not tenable. The size of the capsules and the leaves is relative, and the number of ridges on the capsule is variable. I have seen one side of a capsule with intermediate ridges and the other without them."

We have compared Drummond's No. 148 with No. 181 of Rabenhorst's Bryotheca Europæa, cited by Limpricht in his Laubmoose under *O. anomalum*, and with specimens of this species sent to Dr. Torrey by Greville, from Scotland. We cannot find any constant differences. The leaves are identical, so is the size of the capsules and length of the setæ. The striæ are known to be variable. They are more prominent in Greville's specimen than in Drummond's, and less so in No. 181. The preperistome is hard to see in all three. We are not sure that we distinguished it. The base of the teeth appears more roughly papillose and less striate; there were no cilia present.

We asked Dr. Venturi to tell us what he considered the main difference in var. *Americanum*, and he replied (Nov. 30th, 1893) that he cannot find a scrap of it nor a drawing of the peristome, and does not remember giving the varietal name, and therefore cannot give us the information required. We have been favored with specimens by Prof. Macoun of his No. 872a, from Lake Winnepegoosis, July 6th, 1882, and three other specimens from Ontario and Saskatchewan. The ones from Lake Winnepegoosis have the three or four lower joints of the teeth much thickened and yellow, with large conspicuous ridges; the preperistome is very distinct, and there are no cilia. There are 12 striæ on one capsule, that is the secondary ones were absent in four spaces.

Var. *Venturi* (Kindb).

O. Venturi Kindb. Mac. Cat. part 6: 87 (1892). Canad. Mosses, No. 455, non DeNot.

There is another contradiction here. The Catalogue says: "On cedar (*Thuya occidentalis*) rails, Simon Terrill's farm, Brighton, Ontario;" and the label of No. 455 reads: "On sandstone bowlders, Belleville," Ontario." There is no description.

20. ORTHOTRICHUM NUDUM Dicks.

Type European. We have no American station for this species.

Var. *Rudolphianum* (Schimp.) Vent.

We note that Venturi maintains this as a variety, and Limpricht unites it with the species. Macoun's Catalogue cites the variety as collected by Drummond "on rocks near the Whirlpool, below Niagara Falls; also along Kootenai Lake, British Columbia." Dr. Venturi has recently determined specimens collected by R. S. Williams, No. 59, at Great Falls, Montana, and No. 185, collected by J. B. Leiberg, at Lake Pend d'Oreille, No. 185, on granite ledges, as this variety.

21. ORTHOTRICHUM CUPULATUM, Hoffm.

As we have already shown, this species is not definitely known from the Eastern States. We have three Western specimens so named: J. B. Leiberg's No. 304, from calcareous ledges, Lake Pend d'Oreille, Idaho; Macoun's, from Arrow Lake, British Columbia, on rocks; and Howell's, No. 10, from Steens Mountain, Oregon, May, 1885. Also recorded by Lesquereux, collected by Bolander. "On metamorphic limestone rocks, near the Russian River, Ukiah."

More material and study is required to learn the range of this species.

22. ORTHOTRICHUM URNIGERUM, Myrin. Coroll. Fl. Upsal. 71 (1834).

Type European. "On silicious rocks of mountainous regions in Switzerland and Norway, not common." (Musc. Gall. 163 1887).

This species has recently been reported by Dr. Venturi from Röll's Collection in Yellowstone National Park, Wyoming. It differs from the rest of the group in having no preperistome. It has 16 cilia and a hairy calyptra, and the capsules are immersed, with 16 striæ.

***Euorthotrichum.* Capsules with only 8 striæ and no preperistome. Usually tree species, rarely on rocks.

II. GROUP OF O. DIAPHANUM.

23. ORTHOTRICHUM DIAPHANUM (Gmel.) Schrad.

Type European. Venturi says this species is quite common on trees and walls in Central Europe, more rare in the mountains and the North of Europe. Braithwaite says: "This little moss is easily overlooked, as it only grows in small tufts and somewhat sporadically; it may be recognized at once by its hyaline points to the leaves." It also has 16 cilia and a smooth calyptra.

It has been collected by Wright at San Marcos, Texas; and by Brandegee in Colorado (Bot. Gaz. **9**: 151, 1884).

24. ORTHOTRICHUM CANUM Mitt. Journn. Linn. Soc. **8**: 26 (1865). L. and J. Manual, 176 (1884).

Differs from the last species in the shorter hyaline point of the leaves, the hairy calyptra, and the cilia of two rows of cells.

Type locality, British America; Drummond, also reported with a ? from San Marcos, Texas, Wright. A note in Sullivant's herbarium states: "That the parcel with Wright's specimens has two forms, one referable by its foliage to *O. diaphanum*, the other appears to be *O. canum*, Mitten." It seems probable that all of Wright's Texan specimens are *O. diaphanum*, and that *O. canum* is too close to be a good species. That *O. diaphanum* is a variable species is shown by the three described varieties cited by Limpricht, one of which has a naked calyptra, and another sparsely hairy; the third is an aquatic form.

III. GROUP OF O. RIVULARE.

Plants more or less aquatic, dark green. Leaves blunt, vein ending below the apex, capsule immersed, 8-ribbed, teeth united in pairs and reflexed when dry, cilia 16, calyptra smooth.

25. ORTHOTRICHUM RIVULARE Turn.

Type European. Venturi says "it seems abundant in North America, where the upper leaves are more frequently denticulate at the point." It seems to be confined to the Pacific Slope, having been found only in California, Oregon and Washington (Suksdorf).

26. ORTHOTRICHUM SPRUCEI Mont.

A very rare species, known from only a few stations in France and Belgium, besides the British localities.

It has recently been determined by Dr. Venturi as No. 208, collected by J. B. Leiberg "on Willows overhanging in the old Channel of Clark's Fork of the Columbia River, evidently submerged during high water. Only a few specimens found, September 14, 1889."

Philibert records a hybrid between *O. Sprucei* and *O. diaphanum*. (Rev. Bryol. 10: 8, 1883), also on periodically submersed willows near Bruailles, France.

27. ORTHOTRICHUM EURYPHYLLUM Vent. Bot. Cent. 44: 417 (1890). Hedwigia 32: 268, 281 (1893).

Dr. Venturi remarks that this species may also possibly be a hybrid, as it unites the characters of two groups, having the leaf form and peculiar strong cilia of *O. rivulare*, and the form of the capsule and peristome of *O. cupulatum*.

Type locality, Cascades at Ellensburgh, Washington, Röll. On stones by the river near Thorp.

IV. GROUP OF O. PULCHELLUM.

Dr. Venturi states, Hedwigia, **32**: 275 (1893), that Dr. Röll collected more forms of this group than occur in Europe, and concludes from their examination that the color of the peristome is of little value, as he found on the same clump some capsules with colorless teeth and others with colored. The form of the leaf appears to be more constant, the margins being more revolute in American specimens than in European, and the leaves are generally longer and narrower, with the fruit scarcely rising above the perichætial leaves. The specimens with broad and short leaves and seta 5 mm. long, with capsules larger and more exserted, he thinks are referable to *O. Columbicum* Mitt.

The group is characterized by an exserted capsule, faintly striate, the teeth united in pairs or parted to base, with 16 appendiculate cilia, united by a basal membrane, and the leaves faintly papillose. The following species are included, and two varieties have have been described which need comparison with previously recognized ones. In fact the whole group is in need of revision, there being two of Mitten's species which are poorly understood.

28. ORTHOTRICHUM PULCHELLUM Brunton.

Type locality, European; also reported as collected by E. Hall in Oregon, and by Harrington in Alaska.

Var. *longipes* Sull.

The description seems to agree with that of the European form known as *O. Winteri*, and agrees with the figures given by Venturi Musc. Gall. *t. 52*), whereas the description of *O. Columbicum* agrees with that of the typical *O. pulchellum*. Locality not stated.

Var. *productipes* R. & C. Bot. Gaz. **15**: 43 (1890).

Much more robust than the type, with larger leaves, a longer pedicel (4–6 mm.), and the teeth of the peristome larger and paler.

Oregon, on trees and shrubs, L. F. Henderson.

"Perhaps identical with var. *longipes* Sull., but the description of this last variety in the Manual 175 is too incomplete to allow a positive identification." It will be noted that Venturi includes this variety under *O. glabrum*.

Var. *leucodon* Vent. Bot. Cent. 44: 419 (1890). Hedwigia, 32: 285 (1893).

Differs in the paler color of the plants, capsules and peristome, and in the seta, 5 mm. long.

Type locality, Vancouver Island and Tacoma, Washington, Röll.

29. ORTHOTRICHUM ULOTÆFORME R. & C. Bot. Gaz. 15: 42, *t. 7b* (1890).

Orthotrichum glabrum, Vent. Hedw, 32: 285 (1893).

Dr. Venturi states that specimens sent to him by Renauld and Cardot as *Ulota glabra* and *Orthotrichum productipes* are forms sufficiently distinct from *O. pulchellum* to rank as a species, and he adopts the first specific name, but transfers it to *Orthotrichum.* That is, he takes a manuscript name and rejects the printed name, for *Ulota glabra* R. & C., m. s. is given an equivalent to *O. ulotæforme* by the authors. It is by the first name it must stand. Differs from *O. pulchellum* in the teeth united in pairs to apex, cilia 16, united at base, with a broader, more constant basal membrane. This species suggests a *Ulota* by its somewhat curled leaves, long, exserted capsules, on a slender seta. But it has immersed stomata, and 16 cilia, with a smooth calyptra, and evidently belongs with the group of *O. pulchellum.*

Type locality, Coast Mountains, Oregon, Henderson, on bushes, also collected by Röll at Weston, "Enumclaw," Washington.

30. ORTHOTRICHUM COLUMBICUM Mitt. Journ. Linn. Soc. 8: 24 (1865).

This species has been referred as a variety to *O. pulchellum* by Sullivant, but in the light of modern ideas as to the specific values, it will have to be compared with recent new species to determine its value. Dr. Venturi states that he has a specimen shared with him by Lindberg which is named *O. Columbicum*, Mitt., which he supposed to be authentic, but which does not agree with the remarks in the Manual. The Manual states that *O. Colnmbicum*, Mitt., is according to Sullivant's note in his herbarium a variety with shorter perichætial leaves, the male flowers on short terminal branches, the capsule subexserted on a short pedicel, and the teeth and cilia 8. Sullivant probably saw the type, as he had all of

Mitten's American specimens here for several years before he died. They were not returned to Mitten till quite recently (1891) by Dr. Watson at my request. Mitten's original description does not throw any light on the points in question.

Type locality, "on trees Vancouver Island, Lyall."

31, ORTHOTRICHUM CONSIMILE Mitt. Journ. Linn. Soc. **8**: 24 (1865). Sull. Icon. Suppl. 59 *t. 43* (1874).

"Allied to *O. pulchellum*, differing especially in the shorter, broader capsule, teeth papillose, not vermicular, cilia 8, smooth, and in the uniformly papillose leaves." Sullivant's figures in the Supplement are presumably from the type.

Type locality, Vancouver Island, Lyall. The specimens distributed as No. 125 in Macoun's Canadian mosses, are listed in the Catalogue *O. pulchellum*. They are larger than the type, with longer pedicels and smooth calyptras. The teeth also are papillose on the outside, and striate inside, like those of *O. pulchellum*. The cilia are 16.

We have seen the type and have the following notes: Plants small, 5–7 mm. high, light yellow; leaves short, 1–2 mm. long. papillose, often more acuminate than figured by Sullivant, ending in a single cells, seta short 2 mm. capsule short 1–1.25 mm. elongated and striate when dry, splitting between the ridges when old, striæ strongly differentiated, of 4 rows of equal cells with thick walls, the spaces between them very thin; cells around the mouth small and round, annulus large, persistent; teeth pale, short incurved, when dry, the outer surface papillose, the inner striate, but as often transversely as perpendicularly, and less distinctly than in *O. pulchellum*; spores .010–.013 mm., rough, brown.

We have specimens from Marshall A. Howe, No. 74 collected on trees at Olema, Marin Co., California, January 11th, 1894, which agree pretty well with *O. consimile*, but are larger with longer capsules. Those collected by C. V. Piper on trees, Seattle, Washington, 4.10, 1891, and distributed as No. 104b, by Prof. Eaton in his Musci Occidentali Americani are evidently *O. pulchellum*, having longer setæ, and 16 cilia.

V. GROUP OF O. PALLENS.

In this group are included *O. pallens*, *O. Canadense*, *O. alpestre*, and *O. Watsoni*. They are characterized by the immersed or partially exserted capsules, tapering into the seta with a neck usually as long as the sporesac, and more or less strangulate when dry. Leaves narrow, with the vein ending in the apex, teeth reflexed in pairs, cilia 8 or 16. Several of these species are poorly understood, or have been collected only once.

32. ORTHOTRICHUM PALLENS Bruch.

Leaves blunt, strongly papillose, calyptra naked, teeth united in pairs, reflexed when dry, cilia 16, alternately longer and shorter; stomata immersed but wide open, often showing the outlines of the guard cells.

Type European, grows on trees, especially on beeches, in the mountains of Europe, rarely on rocks. It has been credited to North America by Mitten, from specimens collected by Lyall, Pack River, British Columbia. (Journ. Linn. Soc. **8**: 23, 1865.) Not since reported.

Var. *parvum* Hedw. (Hedwigia **12**: 1873; **32**: 284, 1893.)

Plants smaller, yellowish green, the capsules with neck and pedicel not reaching 2mm. in length.

Collected by Röll in Yellowstone National Park, Wyoming.

33. ORTHOTRICHUM CANADENSE Br. and Sch.

We have already discussed at length the merits of this species. (Bull. Torr. Bot. Club, **21**: 9, 1894).

Drummond's Nos. 149 and 151, from Upper Canada, have been referred to this species and the following one.

34. ORTHOTRICHUM ALPESTRE Hornsch.

Differs from *O. pallens* in having only 8 cilia and a hairy calyptra; the teeth are striate at apex. More closely related to *O. stramineum*, having been referred to it as a variety.

Type locality: European, on rocks in Alpine regions. Has been collected by R. S. Williams, Belt Mountains, Montana, No. 96.

35. ORTHOTRICHUM OCCIDENTALE James, Bot. King's Exp. 402 (1871).

Var. *majus* L. and J. Man. 169 (1884); Sull. Icon. Musc. Suppl. 69, *t. 51* (1874).

As already remarked in the BULLETIN (**21**: 10, 1894), this variety is poorly understood, and is based on two specimens, one of which, Drummond's No. 149, was included in *O. Canadense* Br. and Sch., and Watson's specimens from Utah. The name given by James has priority over the varietal name in the Manual, for

Sullivant, although he figured it in the Icones *t. 51*, gave it no name.

36. ORTHOTRICHUM WATSONI James, Bot. U. S. Expl. Exp. 40th Par. 401 (1871); Sull. Icon. Suppl. 73, *t. 54* (1874); L. and J. Man. 168 (1884).

This species has the densely papillose leaves with strongly revolute margins of *O. alpestre*. It also has sub-immersed capsules, which are urceolate when old, with a flaring mouth, and 8 striæ, the teeth united in pairs, and 8 cilia which are described as "robust, punctate." The calyptra is slightly hairy, but the teeth are described as smooth and figured without striations.

Dr. Venturi (Musc. Gall. 163, 1887) refers this species to the group of *O. cupulatum* near *O. urnigerum* var. *Schubertianum*, but says that the description is too brief, and the specimens in his collection do not permit of a decision as to its specific value.

Type locality: On damp rocks in shade, West Humboldt Mountains, Nevada, altitude 5,500 ft., S. Watson. We have the specimens which were collected in June, 1867, and distributed as No. 1402, with autograph label by T. P. James. The plants are 2 cm. tall, yellowish green with spreading leaves, 3 mm. long; the calyptra is brown and more hairy and less glossy than European specimens of O. *alpestre*, or than R. S. William's No. 96, with which they were compared. The Manual says the capsules are without a neck. This is not true, as the striæ of the capsule are continued down into a distinctly twisted neck. No. 1404, collected by Watson in the Pah Ute Mountains, Nevada, in August, also has a little of this species mixed with two others. It was collected at the same elevation, and was distributed as O. *lævigatum* Zett.

VI. GROUP OF O. PUMILUM.

In the Western States, as well as in the Eastern, this species and its allies is but little known, and in Europe they seem to be in the same condition, for Dr. Venturi writes that as understood by him and Grönwall, this species is more closely related to *O. Schimperi* (*fallax*), whereas Limpricht describes it as more nearly related to *O. pallens*, and Dr. Venturi goes so far as to say that he thinks Limpricht has described *O. pallens* var. *minus* as *O. pumilum*, in his Laubmoose, and that he intends to reëxamine all his European specimens, but does not hope to reach a satisfactory conclusion. If the type is accessible this should be possible.

37. ORTHOTRICHUM PUMILUM Sw. Disp. Musc. Suec. 42, 92, *t.* 4 (1799).

This species has an oblong cylindric capsule, half exserted, with a tapering neck and a short seta immersed in the ochrea. The capsules are 1.5 mm. long, occasionally shorter and ovoid, the neck half the length of the sporesac. The striæ are very prominent, teeth united in pairs, cilia 8 of two rows of cells.

Type Norwegian. Frequent on trees in Scandinavia and Northern Germany, rarer in the mountains of Central Europe. This species has recently been determined by Dr. Venturi from specimens in our herbarium, collected by R. S. Williams, No. 52. "On willows mouth of Sand Coulee, Montana, April 1, 1887."

38. ORTHOTRICHUM HALLII S. & L. Sull. Icon. Musc. Suppl. 63, *t.* 45 (1874). L. & J. Manual 170 (1884).

From the description and figures this species seems to be related to *O. alpestre* in its striate teeth, and to *O. strangulatum* Sull. in its slender fugacious cilia, and short seta immersed in the ochrea. The leaves are figured as papillose, and occasionally bistromatic.

In a recent letter Dr. Venturi says: "The specimens of *O. Hallii*, sent to me by M. Schrader, have the teeth erect when dry, and they are striolate. I regard it as belonging to the group of *O. anomalum*, and I have received it in the collection of M. Röll, from Helena, Montana, in the Rocky Mountains, of which I send you a specimen. With *O. pumilum* it is certainly not related."

I have not seen the type, though it probably is at Cambridge, but plate 45 in the Icones Supplement, although it figures the teeth erect, shows them united in fours, with intermediate cilia, and the habitat is given as "on trees." I do not know who M. Schrader was, nor whether we have any reason to suppose that his specimens were authentic, but shall take the first opportunity of examining the type of this species and determining its relation. The specimens sent to me by Dr. Venturi from Röll's collection are without calyptra; the two capsules are still immature, with the lids on, and do not show any very definite characters except the immersed stomata and partly exserted cylindric capsules.

Type locality: "On trees, Rocky Mountains of Colorado, E. Hall." Also collected at Helena, Montana, by Röll, No. 1375.

At Kew, in Schimper's herbarium, there is a specimen labelled *O. Hallii* with also a manuscript name of Schimper's (*O. leptocarpum*, Sch. m. s.), collected by Drummond, locality not stated; but these specimens have no cilia, and the teeth are papillose, not striate. Macoun has recently sent us specimens labelled *O. Hallii* (fide Kindberg), which proved to be *O. strangulatum* Sull.

39. ORTHOTRICHUM OHIOENSE S. & L. (Sull. Icon. Supp. 66, *t. 48* (1874).

This species is very common in the Eastern States, growing on trees mixed with *O. strangulatum*, Sull., ranging from Georgia and South Carolina, north to Ontario, west to the foot of the Rocky Mountains, in Montana, Röll, No. 1267, recently reported by Venturi. (Hedwigia **32**: 284, 1893).

VII. GROUP OF O. TENELLUM.

In this group are included two European species, *O. tenellum* and *O. Rogeri*, and four American, *O. cylindricarpum*, *O. Coulteri* *O. Hendersoni*, and *O. Jamesianum*, the latter being anomalous on account of having no cilia.

40. ORTHOTRICHUM TENELLUM Bruch.

This species is characterized by its faintly papillose leaves, broad blunt points, upper half of the capsule exserted, neck immersed and tapering into a short seta, teeth united in pairs, papillose, cilia 8, calyptra sparsely hairy.

Type European; common in Central Europe on trees. Has also been reported from trees at the base of the Rocky Mountains, collected by Wolf & Rothrock and E. Hall.

41. ORTHOTRICHUM ROGERI Brid.

Differs from *O. tenellum* in its red teeth, shorter naked calyptra, shorter capsule, and leaves occasionally serrulate at apex.

Type European; on trees in the the mountains of Norway, Bohemia, Switzerland and the Tyrol. Not common and resembling *O. pallens*, according to Venturi. This species has been determined from specimens in our herbarium collected by J. B. Leiberg, on trunks of *Tsuga Pattoniana* in the Traille River Valley, Idaho, No. 233 (1890).

42. ORTHOTRICHUM CYLINDRICARPUM Lesq. Trans. Am. Phil. Soc. 13: 6 (1863). Proc. Cal. Acad. Sci. **1**: 17 (1868). Sull. Icon. Suppl. *70, t. 52* (1874).

This species is said to be closely related to O. *tenellum*, differing in the shorter, less acuminate leaves, and the longer pedicel of the broader capsule.

Type locality, on rocks, Dardanelles Cañon, Bolander. Also on the bark of *Quercus agrifolia*, without locality, Bolander. Considering Sullivant's tendency to refer distinct American species to European ones, and the diversity of these habitats, these specimens need further examination. The latter was distributed as No. 178 of S. & L. Musci. Bor. Am. Ed. II. Also collected by Miss Martha R. Mann, "On live Oaks, at Monterey, Cal., February 12th, 1886," and by Marshall A. Howe, on trees at Berkeley, Cal., October, 1892.

43. ORTHOTRICHUM COULTERI Mitt. Journ. Linn. Soc. **8**: 25 (1865).

This species is referred to *O. tenellum*, in the Manual. Mitten says of it: "Very similar in appearance to *O. tenellum*, Bruch, but its capsule exserted beyond the apices of the perichætial leaves, which are more acute, its calyptra more pilose, its cilia short, and its male flowers larger; *O. cylindricarpum* Lesq. is another closely allied Californian species."

Type locality, California, Coulter.

44. ORTHOTRICHUM HENDERSONI R. and C. Bot. Gaz. **15**: 42, *t. 7a* (1890).

This species is allied to *O. stramineum* and *O. Rogeri*, differing from the first in the narrower, longer, flexuose leaves, twisted and slightly crispate when dry, the longer pedicel, the shorter hairs of the vaginule, the teeth are more elongated, darker yellow, split, not cribrose-lacerate at apex; and from the last, in the twisted leaves, not excavate at base, and the capsule suddenly contracted below. On account of the crispate leaves, this moss has the facies of an *Ulota*.

Type locality: On bushes, Coast Mountains, Oregon, L. F. Henderson. We have been favored with a portion of the type. The specimens are old, the peristome gone, and the calyptra is unknown.

45. ORTHOTRICHUM JAMESIANUM Sull. U. S. Exp. Ex. 40th Par. 401 (1871); Sull. Icon. Musc. 71 *t. 53* (1874); L. and J. Man. 177 (1884); Vent. Mus. Gall. 177 (1887); Macoun's Cat. part 6: 92 (1892).

This species is compared with *O. obtusifolium* in the Manual, which it resembles on account of its erect, appressed, blunt, papillose leaves, with the vein ending below the apex; it differs, in having revolute margins and no propagulæ. In fact it belongs to the section with immersed stomata; has a shorter capsule and neck, is pyriform when fresh, urceolate when empty, has a simple peristome of 16 striolate teeth, reflexed in pairs when dry. It is not referable to any of the groups on account of having no cilia, though perhaps it is as closely allied to *O. tenellum* as any by its imbricate blunt leaves. Dr. Venturi is mistaken (l. c.) in stating that Lesquereux and James refer "*O. Jamesonianum*" to *O. rivulare*. We presume he has reference to this species though the spelling is different.

Type locality: On limestone rocks, East Humboldt Mountains, Nevada, Watson, altitude 7,000 feet; Fort St. James, British Columbia, Macoun. Also on rocks at Yale and Spence's Bridge, B. C., according to Macoun's Catalogue; but No. 129 of Canadian mosses, distributed as this species, is in our specimens all *O. obtusifolium.*

SUPPLEMENTARY NOTES ON THE NORTH AMERICAN SPECIES OF WEISSIA (ULOTA).

WEISSIA MEGALOSPORA (Vent.) E. G. Britton.

In the BULLETIN for February (**21** : 74–75, 1894), in comparing Kindberg's *Ulota subulifolia* and *subulata* with *U. megalospora* Vent., we stated that "we should not be surprised to find that these three species were one." We have since learned from Prof. Macoun, that the type localities of Kindberg's two species are the same, in fact he picked them both out of the same specimen, and Prof. Macoun thinks they are the same species. He has not been able to separate them in his herbarium.

Also in a recent letter from Dr. Venturi (March 6th, 1894) he says: "The two specimens which you send me (71, collected by W. N. Suksdorf, at Nooksack river, Washington, and No. 137, *U. subulifolia* Kindb. of Macoun's mosses, from New Westminster Junction, B. C.) are without doubt the same as my specimens of *U. megalospora.* The two specimens which you send do not attain quite the dimensions of the spores that I have seen in the specimens sent me by Dr. Dieck, but nevertheless I have found, particularly in No. 137, spores which reach a diameter of 40–41 micromillimeters. My type specimens attain 54–56 microm., but I see that there is great variety in the dimensions of the spores. I also see that the diagnostic value of the terminal cells of the leaves is purely relative, as in my type specimens the point is very much developed, whereas in your specimens it is shorter, and the upper leaves near the perichætium have not the prolongation into a uniserial set of cells. I find the cochleariform base of the leaves and the long defluent neck of the capsule, as well as its small size and pale color, more constant characters."

These observations agree with my own, only I should add that the tips of the leaves vary even on the same plant, those of the younger branches being more filiform pointed than the lower ones.

The species has now been collected in five localities. The type is from the Cascades of the Rigi, near Clear Lake, Washington, Röll. It has also been collected at Weston, by Röll, on *Alnus rubra*, Nooksack River, Whatcom county, Washington, by W. N. Suksdorf, 1890; on trunks of Hemlock (*Tsuga Pattoniana*) Traille River Valley, Idaho, No. 234, by J. B. Leiberg, besides Macoun's locality at New Westminster Junction, British Columbia.

New Piperaceæ from Bolivia.

By C. De Candolle.

Peperomia R. & Pav.

P. pseudo-rufescens, glabra foliis modice petiolatis rotundatae ovatis noveninerviis nervo centrali paulo supra basin alternotim nervum utrinque unum mittente lateralibus nervis feremedio bifurcatis, amentis oppositifolius modice pedunculatis ipsis florentibus quam folia brevioribus in sicco rufescentibus subdensifloris, bractea orbiculari fere centro peltata ovario emerso globoso-elliptico apice imo stigmatifero stigmate carnoso rotundato puberulo.

In Bolivia prope Cochabamba (Bang n. 1148ª in n. herb. Columb. Coll.)

Herba erecta? inferne radicans caule in sicco complanato coriaceo inferne 6 mm. crasso. Limbi in sicco membranacei

subpellucidi pellucido-punctulati, caulini ad 6 cm. longi 5 cm. lati basi cordati, ramulorum minores ad 4½ cm. longi et ad 4 cm. lati. Petioli foliorum caulinorum ad 3 cm. longi. Pedunculi circiter 1 cm. longi. Amenta florentia 2½ cm. longa circiter 2 mm. crassa.

Species *P. rufescentis* C. D. C. proxima petiolis brevioribus limbis noveninerviis nervulisque magis conspicuis discrepans.

P. Mandonii (C. D. C. in Prodr. 17: Part 1, p. 395), β EXCELSIS

Herba ad 30 cm. alta. Limbi 25–30 mm. longi.

In Bolivia, prope Sorata (No. 1299 in h. Columb. Coll.).

P. PSILOPHYLLA, tota glabra foliis longiuscule petiolatis ovatis basi rotundatis subcordatisve apice brevissime acuminatis acumine acuto subacutore utrinque glabris 11–plinerviis nervis utrinque 5 e basi unoque e centrali infra limbi medium ortis, amentis longiuscule pedunculatis folia pluries superantibus, bractea orbiculari subsessili, ovario emerso vertice oblique complanato-rotundata apiceque imo subacutato verticis in medio stigma parvum carnosulum gerente.

In Mapiri (Bang n. 1516 a in h. Columb. Coll.)

Herba ad arbores scandens caulis 3 mm. crassus in sicco complanatus coriaceus. Folia alterna. Limbi in sicco coriacei opaci pellucido-punctulati ad 6 cm. longi et ad 4½ cm. lati. Petioli ad 5 cm. longi. Pedunculi circiter 3 cm. longi. Amento in sicco 3 mm. crassa obscure rufescentia florentia ad 23 cm. longi.

PIPER L.

P. LONGESTYLOSUM, foliis brevissime petiolatis lanceolato-oblongis basi inæquali acutis apice acute acuminatis supra glabris subtus ad nervos nervulosque adpresse hirtellis, nervo centrali paulo ultra ½ longitudinis nervos adscendentes utrinque 5–6 mittente, petiolo basi ima vaginante utrinque parce hirtello, amentis sessilibus cylindricis quam foliorum limbi pluries brevioribus, bractea spathulata apice extus hirtella, bacca glabra ovata apice in stylum longum stigmatibus minutis terminatum producta.

Espirito Santo, in vicinitate Cochabama (Bang n. 1,233 in h. Boiss. et h. Columb. Coll.).

Ramuli breviter hirtelli, amentiferi in sicco 2 mill. crassi, cortice fasciculis collenchymatosis discretis instructo fibris destituto. Limbi ad 14 cm. longi 4½ cm. lati in sicco membrancei pellucido-punctulati. Petioli ad limbi latus longius circiter 6 mm. longi. Amenta fere matura 2 cm. longa, 8 mm. crassa. Stamina 4 antheris decidius. Bacca circiter 2 mm. longa. Stylus 3 mm. superans.

Remarks on Chara gymnopus A. Br., with Descriptions of new Species of Chara and Nitella.

BY T. F. ALLEN.

[PLATES 185–192.]

The species *Chara gymnopus* A. Br., was proposed in manuscript, by the late Al. Braun, and fully described in his Characeæ of Africa in 1847. Remarking upon the name in the latter work, Braun says: "So long as but few forms were known to me, it seemed easy to separate them into a series of related species, but since 16 to 18 forms have come to my notice I am doubtful whether it would not be more correct to collect them all except the diœcious *Ch. Martiana* and the disjoined monœcious *Ch. sejuncta*, as varieties under one species, for which the name *gymnopus*, though not the oldest, seems most appropriate;" also in a foot-note to this paragraph. "A part of the forms belonging here have formerly been described by me under the name *Ch. polyphylla*, 1858." The oldest name is *Ch. Ceylonica* Klein and Willd., but in accordance with the observations above, this name must be used to designate the most distinguished East Indian species.

It seems to me unnecessary to make any changes in this name, to accord with the universally recognized rules of priority, for the species must in my view be abandoned entirely, and the several varieties be raised to the rank of species, with their appropriate names. Many species, hitherto called varieties, abound in America, and ample opportunity is afforded for continuous observation.

It is, to me, quite evident that these so-called varieties are fully distinct as species, not subject to any greater variability than other species of the genus, indeed their characters are wonderfully constant in identical localities, and furthermore the name *gymnopus* is required to designate a sub-section of the "*triplostichæ corticatæ*," division of *Chara*, namely:

GYMNOPODÆ; *stem and leaves triply corticated; the lowest segment of the leaves naked.* Under this section I am able to place the following new species, giving a later revision of the names of all the species. The dimensions given in this paper are expressed in thousandths of a millimetre (mikrons).

CHARA CUBENSIS sp. nov.

Chara diplostephana, triplosticha, gymnopus, monoica-conjuncta, podosteira.

Stems 40–50 cm. in length, armed with scattered linear spines of variable length, from one-half the diameter of stems in length, to longer than the diameter (.360–.850 mm.); diameter of stem about .780 mm. The leaves usually rather shorter than the internodes in mature plants.

Stipules nearly equal or exceed the length of the lowest leaf-segment, upper, about .850 long; lower .610 long.

Leaves consist of 6–7 segments, of which the first is naked, .900–.975 long, .550 in diameter (varies to 1.098 long, .340 in diameter); first node usually sterile, *sometimes fertile;* second segment usually corticated, 2.500 long, .500 in diameter; third segment, 2.200 long; fourth, 6.500 long, .600 in diameter, usually naked; fifth and sixth (terminal) naked, *at times the whole leaf naked.*

Bracts verticillate, anterior usually exceed the length of the sporophydia, posterior slightly shorter; lateral bracts longer than anterior (anterior .700 long, lateral 1.100, posterior .700), sporophydium .610 long, coronula spreading, .120 high, .220 in diameter. Nucleus .600 long, .400 broad (.585 by .425) with 12 or 13 ridges. Antheridium .360 in diameter. In older specimens the leaves frequently have 7–8 nodes, in some specimens all the leaves are naked.

This species is founded upon a few specimens, now known only in the herbarium of the Missouri Botanical Garden, collected by "Wright" in Cuba, at "*Guyman's,*" and in the river at "*Mayan.*"

It appears to me to be allied to *C. Humboldtii* A. Br., but the nucleus is smaller, so that according to Braun's synopsis, it is allied rather with *C. Ceylonica* Klein.

In Plate 189, Figs. 1 and 2 represent the stem with spines of variable length, the leaves with long, naked, basal segments, one leaf with three additional nodes (one node fertile, continued in fig. 3), a portion of a naked leaf, × 25; fig. 4, nucleus × 50.

CHARA CARMENENSIS sp. nov.

Chara diplostephana, triplosticha, gymopus, monoica-conjuncta, podophora; foliola posteriora breviora, anteriora sporangio æqualia vel paullo longiora, articuli foliorum 9; articulus infimus diametro 4-plo longior; nucleus minor 0.610 mm. longa; caulis circa 25 cm. longus, flexilis, aculeis linearis acuminatis armatus; aculeis ½–1 diametro caulis; stipulæ lineares ½–⅔ articulo infimo longæ.

This species, collected by Dr. A. E. Palmer on Carmen Island, in the Gulf of California, is a slender, long-leaved form, with numerous, scattered, narrowly linear spines rarely longer than half the diameter of the stem; verticils of 8 to 10 leaves, the segments of the leaves usually 9, the lowest naked, then 7 corticated, then a short, rather abruptly pointed tip. The lowest naked segment is about 1.7 mm. long and 0.440 in diameter; the stipules, though long and slender, cover but little more than half this node. The bracts are developed around the leaf nodes, but the posterior are quite short, while the anterior equal or a little exceed the length of the sporophydium. The coronula of the sporophydium is slightly spreading, not connivent; the nucleus is 0.610 mm. long by 0.360 broad, with *twelve* prominent ridges.

This species seems most nearly related to *Ch. Ceylonica* Klein and Willd. (*Ch. gymnopus* var. *Delilei* A. Br.), and *Ch. Angolensis* A. Br., from Ceylon and Africa, and to *Ch. armata* Meyen, from Sandwich Islands; from all of which it is clearly distinguished either by the spinescence of the stem, size of nucleus and by other characters.

In Plate 190, Fig. 1 represents the plant about natural size, figs. 2 and 3 portions of the stem and leaves × 25, fig. 4 nucleus × 50.

CHARA INCONSTANS var. HICKSIANA var. nov. (*Chara Hicksii* Allen in plate 191.)

Chara diplostephana, triplosticha, gymnopus, monoica-conjuncta, podophora; foliola anteriora sporangio breviora, posteriora brevissima; articuli foliorum 4–5; articulus infimus diametro 4–5-plo longior; nucleus 0.650 mm. longa.

This small *Chara* was collected by Mr. Hicks, of the University of Michigan, in one of the lakes of that State; the plant is inconspicuous, only about 4 cm. high, in dense tufts. The stem is remarkable for its very irregular and incompletely developed cortex, the cells of which are short and numerous; the intermediate (secondary) tubes are often suppressed wholly or in part, their places filled by the spreading cells of the adjacent series; the spines are very short and pointed (almost conical). The stipules are well developed but short, as compared with the lowest nodes of the leaves, upper row .425 mm. long; lower row .250 mm. long. Leaves about 10, consisting of only 4 or 5 segments, including the tip, which may be 2-celled The lowest naked node is often very long, as shown in Fig. 5, but usually about 5 times as long as its diameter, (1.5 mm. long, 0.365 mm. in diameter. The lowest node is usually fertile. Bracts, anterior about two-thirds the length of the sporophydium, posterior very short. Coronula short, of somewhat diverging cells; nucleus about 0.650 long by 0.360 broad, with 12–13 striæ. Antheridium 0.315 mm, in diameter.

This species seems to be referable to *Ch. inconstans* A. Br., but to differ from the two forms, both belonging to the West Indies, *C. Œrstediana* and *C. Cruegeriana*, by the large nucleus, as well as the characters of the stem and leaves; the irregular cortex of the present gathering may not prove to be constant in this variety.

In Plate 191, fig. 1, plant natural size; figs. 2–5 × 25; fig. 7 nucleus × 50.

NEW SPECIES OF NITELLA.

The species now to be described supplement the first fascicle of the second (systematic) part of my Characeæ of America, recently issued.

NITELLA MEXICANA sp. nov.

Nitella monarthrodactyla, furcata, homœophylla, monoica, gymnocarpa, apiculata; group of *N. flexilis* Ag.

Stem large, .730 to 1.098 in diameter, verticils of 8 leaves: leaves about .585 in diameter, once divided; terminals 2–3, about .365 in diameter; sporophydia aggregated (usually) 1–3 in number at node of leaf; nucleus .275 long, .230 broad, with 5 prominent striæ; membrane of the spore very minutely granular. Antheredium .245 in diameter.

This robust species, collected by Mr. Pringle in slow-flowing streams in Mexico, appears at first sight to belong to *N. flexilis* Ag., to which it is clearly allied; it differs, however, by its much smaller spore and antheridium (in *flexilis* the spore is .450 long), the membrane of which is granular (instead of smooth as in *flexilis*).

Plate 186, fig. 1, nat. size, figs. 2, 3 and 4 × 25, fig. 5 × 50.

NITELLA CALIFORNICA sp. nov.

Nitella monarthrodactyla, furcata, homœophylla, gymnocarpa, monoica, apiculata.

Plant of medium size, aspect of ordinary *N. flexilis*; leaves once divided, terminal divisions one-celled, abruptly pointed, terminals of sterile leaves elongated, of fertile leaves shorter, often incurved; sporophydia aggregated, usually 2 at a node, coronula evanescent; spore (nucleus) .500 to .535 long, .450 to .530 broad, with 6 or 7 prominent striæ; membrane of spore granular. Antheridium .285 in diameter.

This species has been collected in different places in California, in two forms: 1, the ordinary, diffuse form; and 2, forma *nidifica*, closely resembling a species of *Tolypella*, in the compactness of the fertile verticils. It differs clearly from *N. flexilis* Ag., which it closely resembles and to which it is most nearly related by the size of the nucleus and particularly in the granular membrane of the spore. These markings on the spore differ also from those of *N. Mexicana* Allen, by being much coarser; the spores are also larger than *Mexicana*.

The ordinary form collected by Mr. J. W. Blankinship, in Lake county.

The forma *nidifica*, collected by the same gentleman in Humboldt county, June 12, 1893.

Plate 185, fig. 1, nat. size, fig. 2 × 25, fig. 3 × 50.

NITELLA OCCIDENTALIS sp. nov.

Nitella monarthrodactyla, furcata, homœophylla, gymnocarpa, dioica, acuminata, sporophydia aggregata.

Plants small, 8–10 cm. in height, delicate, .535 in diameter; leaves 6, .440 in diameter, once divided, terminals acuminate, .170 in diameter at base; sporophydia 2–3 at the fork of the leaves; nucleus .390 long by .320 broad (variations .345, .360 and .390 long by .320, .340 and .365 broad), with 6 ridges not prominent; membrane roughened with elevations, ridges and depressions. Antheridium about .800 in diameter.

This plant differs from *N. montana* Allen, in the smaller nucleus, which is differently sculptured and the larger antheridia.

The whole plant is also rather larger than *N. montana*. From *N. Blankinshipii* Allen, it differs in the smaller nucleus, which is differently sculptured and by the larger antheridia. The general size and appearance of the plant resembless *N. Blankinshipii;* in that plant, however, the oogonia are single, aggregated in *occidentalis*.

Collected by Mr. Blankinship, in California, Lake county, June, 1893.

Plate 187, figs. 1 and 2, male and female plants, natural size (male plants more diffuse; female terminals longer); figs. 3 and 4 × 25, fig. 5, nucleus × 50.

Plate 188. To illustrate the description of *N. Japonica* Allen, BULLETIN, vol. **20**, page 120. Fig. 1, plant natural size; figs. 2, 3, 4 and 5 × 25; fig. 6, coronula of sporophydium, showing the elongated terminal cells, separated × 50; fig. 7 nucleus × 50; fig. 8 surface of same, covered with minute conical spines highly magnified.

CHARA DEPAUPERATA sp. nov.

Chara diplostephana, triplosticha, gymnopus, monoica—conjuncta, podosteira.

Plant small, condensed, but about half a cm. in height; stems armed with numerous spines, which are about as long as the diameter of the stem; stipules large, comparatively longer than the basal node of the leaf; leaves of 5 to 7 nodes, lowest segment naked, .480 long, .315 broad, second segment corticated, .610 long, .290 broad, the remaining segments successively shorter and smaller; the terminal, naked tip short and conical; the whole leaf about 2.4mm. long, the lowest node sterile; bracts verticillate, the anterior bracts somewhat longer than the sporophydium, the posterior but little shorter; sporophydium large, coronula spreading, short; nucleus (spore), very large for the size of the plant, .660 long, .650 broad (.635 × .440), with eleven or twelve ridges, not prominent.

This species, collected near Nassau, N. P. (West Indies), by the late Dr. Northrop, seems to be allied to *Ch. Ceylonica* Willd. But one collection of a very few specimens was made. Plate 192.

New and interesting Species of Polygonum.

[PLATES 193–196.]

BY JOHN K. SMALL.

The following notes are mainly the results of a study of the specimens representing the American species of the genus *Polygonum*, preserved in the Herbarium of the Missouri Botanic Garden, which Dr. Trelease has kindly given me the opportunity to examine, and also a large collection from the Gulf region of Southern Louisiana, which Rev. A. B. Langlois has put at my disposal.

POLYGONUM OPELOUSANUM Riddell; Small, Bull. Torr. Club, **19**: 354 (1892).

Rev. A. B. Langlois has found this form at Pointe à la Hache, Louisiana. The locality is some distance south of Opelousas, Mr. Carpenter's original station. At Pointe à la Hache it grows in ditches and rice fields, and is probably a quite common species about the Western Gulf region.

By the aid of various herbaria the following range is shown: Opelousas, Louisiana, and Pointe à la Hache to the False Washita, Indian Territory (Palmer), and Orizaba, Mexico (Muller).

POLYGONUM MINUS Huds. Fl. Angl. 148 (1762).

Heretofore known to occur on the Western Continent only in Chili. In the George Engelmann Herbarium of the Missouri Botanic Garden, I find a specimen of this species with the accompanying label reading thus: "Introduced, gardens and yards, Feliciana, Louisiana, Wm. Carpenter, No. 9."

Mr. Carpenter was unable to identify the plant, judging from a note left on the label. It is clearly this species and the first and only specimen thus far known to occur in North America.

POLYGONUM PUNCTATUM ECILIATUM Small, Bull. Torr. Club, **20**: 214 (1893).

I find in the National Herbarium a specimen of the Persicaria section, whose label bears simply *Polygonum*, and the record of locality, date, etc. It is clearly my lately described *P. punctatum eciliatum*. The plant has the characters of the type, especially the entire and eciliate ocreæ, and although rather old, the dark reddish-purple color of the racemes is apparent.

Collected in the region of Orizaba, Mexico, by M. Bourgeau, 1855–1856, No. 2678.

Since writing the above paragraph I have seen another specimen identical with the type from the Valley of Toluca, Mexico. It was found in wet places near Knoxville, Tennessee, by Mr. T. H. Kearney, Jr., on August 29, 1891.

The striking extension of the range of this well-marked variety is quite unexpected.

POLYGONUM LONGISTYLUM n. sp.

Annual or perennial, glabrous except the upper branches and peduncles. Stem erect, 3–6 dm. tall, branched throughout, somewhat enlarged at the nodes, more or less ribbed, becoming woody below; leaves lanceolate or narrowly-lanceolate, sometimes ovate-lanceolate, 3–10 cm. long, .5–2 cm. broad, acuminate, slightly crisped, undulate and more or less ciliolate, petioled, acuminate at the base; petioles 5–12 mm. long; ocreæ cylindric, entire, thin, brittle and soon falling away; inflorescence consisting of terminal spicate-racemes, somewhat glandular; racemes cylindric, 2–8 cm. long, 1 cm. broad, dense; flowers about 5 mm. broad, lilac; calyx 5-cleft to below the middle, petaloid; segments broadly oblong, obtuse; stamens 6 to 8, included; style 3–3.5 mm. long, slender, conspicuously exserted; stigmas dark-colored; achene lenticular 2.5 mm. long, broadly ovoid, slightly gibbous on the sides, black, very sparingly roughened, somewhat shining or dull. (Plate 193.)

New Mexico—(Fendler, 749); Texas—Houston, Harrisburg, etc. (Lindheimer); Louisiana—Jackson (Carpenter); Illinois—opposite St. Louis (Engelmann); Missouri—Dauphin county (Bush).

While studying various collections of *Polygonum*, fragmentary specimens of a form related to *P. Pennsylvanicum* came under my notice. Owing to the scanty material, I was compelled to pass them by. However, good material is preserved in the George Engelmann Herbarium, which leads me to the above decision. In aspect the plant resembles *P. Pennsylvanicnm*, but differs in the remarkably long style, smaller and duller achene, the longer petioled and more strictly lanceolate leaves. It stands between *P. Mexicanum* and *P. Pennsylvanicum*, both morphologically and geographically.

Dr. Engelmann referred the form to the latter species, provisionally, remarking that the achene was too small, and further it is not orbicular or depressed-orbicular as in *P. Pennsylvanicum*, but broadly-ovoid and slightly gibbous.

Polygonum Mexicanum Small, Bull. Torr. Club, **19**: 356 (1892).

A species of the Mexican Flora new to the United States. Recently discovered by Rev. Mr. Langlois, who gives me the following information: Growing in fields, ditches, etc., about St. Martinsville, Louisiana. It is common, often attains a height of 12 to 15 decimeters, and is very attractive on account of the abundance of its fine flowers.

Polygonum densiflorum Meisn. in Mart. Fl. Bras. **5**: 13 (1855).

Here is a case in which a species of the Gulf region follows the Mississippi River Valley as far as Southern Missouri, thus coming into the region of the "Northern Flora."

The plants vary a little from some of the southern forms in having narrower leaves, and the achene is broadly oblong instead of orbicular. It has been found at two localities in Missouri, Dunklin county, September 18, 1893 (Bush, 116), and swamps, Southeastern Missouri, November 19, 1893 (Trelease).

On Lindheimer's specimens from Texas varying from the type, towards a more slender build and corresponding to these plants from Southern Missouri, Engelmann once thought of founding a species *P. Texanum*, but left, as far as I have been able to learn, only a manuscript name.

✓ Polygonum Newberryi n. sp.

Perennial, dull green, fleshy and stout, more or less puberulent throughout or sometimes glabrous. Stems apparently 2–4 dm. tall, stout, slightly channeled, more or less flexuous, strongly puberulent (in the type), nearly simple or short-branched above; internodes about 3 cm. long near the base, 1 cm. long near the summit of the stem, primary internodes of the branches about ¾ the length of the opposite stem internodes; leaves ovate or broadly oblong-ovate, 1–4.5 cm. long, .5–3 cm. broad, subsessile or short petioled, obtuse or subapiculate, acute or obtuse at the base, sometimes truncate, fleshy, becoming more or less rugose wrinkled with age and in drying, attached near the base of the ocreæ; ocreæ funnel-form, light brown, pubescent or nearly glabrous, thin and brittle; inflorescence of a few axillary racemes; racemes narrow, short (1 cm. long), few-flowered, sometimes slightly interrupted; flowers 5–6 mm. broad; calyx 5-parted, the 2 outer sepals conspicuously larger than the 3 inner; stamens 8, included, anthers large; style 3-parted, included; achene slightly obovoid and unsymmetrical, about 2 mm. long, light-brown, smooth and shining. (Plate 194.)

Found in the Cascade Mountains of Oregon, at Crater Pass, by Dr. Newberry, September 1, 1856, growing in scoria near the snow line, 7,000 feet altitude. There is a specimen of *Polygonum* in the Columbia College Herbarium, collected by Mr. Frank Tweedy, of the Northern Transcontinental Survey, in July, 1883. It is from the Yakima region, Washington, altitude 6,000 feet. This specimen can safely be referred to *P. Newberryi*, and is not *P. Davisiæ*, under which name it was distributed. The plant from the Yakima region is apparently less stunted and nearly smooth, but these differences can be accounted for by the lower altitude of its habitat.

P. Newberryi is intermediate between *P. alpinum* and *P. Davisiæ*, possessing the reduced and short racemes of the latter species and bearing an achene more like that of the former. With many minor characters it is strikingly different from all its other relatives of the Aconogonon Section.

The type of this species reached Dr. Torrey in 1857, the year after Dr. Newberry collected it in the Cascade Mountains. In some way the plant was mounted on a sheet of *Rumex venosus*, where it remained unstudied up to the present time.

POLYGONUM CAMPORUM Meisn. in Mart. Fl. Bras. **5**: 21 (1855).

Heretofore this species has not been known to grow very far east of the 100th parallel, but Rev. Mr. Langlois has it from St. Bernard county, Louisiana, where it thrives in low, grassy and saltish ground near the Gulf of Mexico. This brings the plant very near the Mississippi River.

POLYGONUM RAMOSISSIMUM PROLIFICUM n. var.

Very bushy. Stem erect 6–10 dm. tall, rather stout; internodes short; nodes proliferous, producing 2 or more branches; leaves variable in size and narrower than those of the typical form; flowers and achenes more numerous than usual.

Referable to *P. ramosissimum* by its ocreæ and achene, but differing conspicuously from any form of that species by its peculiar mode of branching, which gives it a dense appearance, and the other characters cited above. Collected at Exeter, Nebraska, by Rev. J. H. Wibbe.

POLYGONUM EXSERTUM n. sp.

Annual or perennial (?) slender, glabrous, sometimes somewhat glaucescent, of a light or dark brownish color. Stem erect or nearly so, 4–9 dm. tall, flexuous, rather conspicuously ribbed, branched above or throughout; branches slender and quite erect; leaves narrowly or linear-lanceolate, sometimes obovate, 1–6 cm. long, .2–.7 cm. broad, acute or cuspidate, acuminate at the base, nearly sessile; ocreæ several-parted when young, soon much lacerate, silvery or brownish, especially about the base; inflorescence consisting of axillary clusters bearing from 2 to 4 flowers; calyx greenish, but small and inconspicuous, 6-parted to near the base; segments oblong, obtuse; stamens 5 or 6, included; style 3-cleft, very short or the stigmas almost sessile; achene triquetrous, 4–6 mm. long, narrow, triangular-pyramidal, rounded at the base, more or less constricted above the middle, chestnut color, smooth and shining, exceeding the calyx by ⅓ to ⅔ of its length and slightly spirally twisted when mature. (Plate 195.)

Sandy banks of Spirit Lake (Geyer, Nicollet's Northwestern Expedition, No. 138), south to Valentine, Nebraska (Bates), east to St. Louis, Missouri (Engelmann), also at Providence and Barrington, Rhode Island (Olney), and York Harbor, Maine (Bicknell).

The species here described has passed through an interesting history. Botanists under whose notice the plant has come have either left it undetermined or have given it a name with more or less doubt. It was apparently first collected by Chas. A. Geyer at the source (Spirit Lake) of the Little Sioux River, on September 30, 1839. No name was assigned to this specimen. The next collection was made by Engelmann at St. Louis, in September, 1845, on both banks of the Mississippi River. These specimens were labeled *P. ramosissimum* with some doubt. Later, in 1856, Mr. Olney found the plant at two localities in Rhode Island, namely: Providence and Barrington. He, like Engelmann, called them *P. ramosissimum* with more or less doubt. The last collections were by J. M. Bates at Valentine, Nebraska, in 1891, and by E. P. Bicknell at York Harbor, Maine. The most curious thing about the species is this: It has the general habit and aspect of *P. ramosissimum* and the inflorescence and fruit of *P. Rayi*. Its resemblance to the latter is so strong that for some time I was inclined to regard it as a form of that species, but a careful study has forced me to dispose of it as recorded above.

POLYGONUM SAWATCHENSE Small, Bull. Torr. Club, **20**: 213 (1893).

While examining some plants in the United States National Herbarium a short time since, I was surprised to find several specimens which I at once recognized as new representatives of my *Polygonum Sawatchense.* They are nearly like the original in every respect.

One specimen is rather strict and was collected in the Yellowstone Park, by Mr. Tweedy, in 1885. The other specimen is from Castle Rock, in the foot-hills of the Rocky Mountains near Golden, Colorado, altitude about 6,000 feet, gathered on July 1 and September 9, 1885, by Mr. Patterson, No. 128. The plants of the last collection are more elongated and rather straggling. This difference is most likely due to their unlike habitats and altitudes.

POLYGONUM DUMETORUM L. Sp. Pl. Ed. 2, 522 (1762).

Recently collected in the vicinity of Knoxville, Tennessee, by Prof. F. Lamson-Scribner. Its geographical range may be defined thus: Eastern Missouri, the prairies of Illinois and Eastern Tennessee.

POLYGONUM CRISTATUM Engelm. & Gray, Bost. Journ. Nat. Hist. **5**: 259 (1847).

This I found in the United States National Herbarium under the name of *Polygonum dumetorum*, collected by W. H. Ravenel at Aiken, South Carolina, in September, 1869. In my Preliminary List of American Species of Polygonum, two localities for this apparently rare plant are cited, and now we have the third. It may be that the species has often been overlooked on account of its close resemblance to its nearest relatives *P. scandens* and *P. dumetorum*, and we may expect to find it at intermediate stations between Texas and South Carolina. (Plate 196.)

The Nomenclature of the Genus Büttneria Duham.

BY T. H. KEARNEY, JR.

BUTNERIA (correctly BÜTTNERIA) Duhamel, Traité des Arbres et Arbustes, **1**: 113. *t. 45* (Sept., 1755).—Not *Byttneria* Löfl. It. Hisp. 313 (1758).

Beurera Ehret, Pl. et Pap. Rar. Depict. *t. 13* (1755).
Basteria Mill. Fig. Pl. *t. 60* (Dec. 30, 1755).
Calycanthus L. Syst. Ed. 10, 1066 (1759).

There are three excellent reasons for preferring *Büttneria* to *Beurera* as the name of this genus:

(1.) Ehret's Tab. 13 was not, so far as I can learn, distributed, and was certainly not included by Trew in his "Plantæ Selectæ." For this reason *Beurera* is not, strictly speaking, a published generic name.

(2.) *Büttneria* should be considered as having priority over *Beurera*, for it seems to be impossible to ascertain the exact date of Ehret's Table 13, although, as Dr. Kuntze tells us, the plate bears the date of the year 1755, in which it was registered. While admitting the apparent impossibility of ascertaining more exactly the date of the table, Kuntze states categorically: "Die Tafel 13 ist aber wahrscheinlich früher als September erschienen."* No word of evidence is adduced to prove this statement. Now, though no such rule has been formulated, it would seem that, in such a case, justice to the authors of other names would demand that we place the date of the plate at the very end of the year 1755.

In a letter from Peter Collinson to Linnæus,† dated May 12, 1756, this sentence occurs: "Mr. Ehret has only [just] published the *Beveria*, being what at Paris is named *Butneria*." This remark can bear but one construction, that which I have given it by inserting the word "just." As Collinson's last letter to Linnæus before that of May 12, 1756, is dated July 29, 1755, and contains allusions to Ehret's work, but none to the "*Beveria*," the probability is great that the Table 13 was not officially entered before the last months of 1755. Collinson, it may be added, was in constant personal communication with Ehret at this time, and his frequent letters to Linnæus evince the interest he felt in the artist's work. As accurate knowledge seems impossible, even such purely circumstantial evidence should have some weight. Duhamel's work was registered in August and published in September of the same year.

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* Rev. Gen. Pl. 1: 5.

† Correspondence of Linnæus, Sir J. E. Smith, London, 1821, 1: 38.

(3.) The Table 13 bears the short, descriptive phrase "Beureria petalis coriaceis oblongis, calycis foliolis reflexis," which is a polynomial specific name rather than a generic definition. As no species are cited or described, *Beureria*, were it not to be rejected for other reasons, must be relegated to the limbo of "nomina nuda."

The species of *Büttneria*, all North American, are as follows:

(1.) Büttneria occidentalis (Hook. & Arn.) Greene, Erythæa, **1**: 207 (1893).

Calycanthus occidentalis Hook. & Arn. Bot. Beech. 340, *t. 84* (1841).

(2.) Büttneria florida (L.).

Calycanthus floridus L. Syst. Ed. 10, 1066 (1759).

Calycanthus sterilis Walt. Fl. Car. 151 (1788).

Beurera florida Kuntze, Rev. Gen. Pl. 5 (1891).

(3.) Büttneria fertilis (Walt.).

Calycanthus fertilis Walt. Fl. Car. 151 (1788).

Calycanthus ferax Michx. Fl. Bor. Am. **1**: 305 (1803).

Calycanthus nanus Loisel, in Duham. Traité des Arbres, Ed. 2, **1**: 219, *t. 48* (1801–4).

Calycanthus glaucus Willd. Enum. 559 (1809).

Calycanthus lævigatus Willd. l. c.

Calycanthus inodorus Ell. Bot. S. C. & Ga. **1**: 576 (1821).

Beurera fertilis Kuntze, Rev. Gen. Pl. 5 (1891).

Beurera ferax Kuntze, Rev. Gen. Pl. 5 (1891).

The form best known as *Calycanthus lævigatus* is not sufficiently distinct from typical *Büttneria fertilis* to be maintained as a species. Almost every one who has seen the two forms in the natural state is of this opinion. Theonly character which serves to distinguish them, the presence or absence of bloom on the under surface of the leaf, seems to be due to the immediate influence of habitat. I have seen the same plant exhibiting every gradation from the white under-leaf surface of one form to the green surface of the other. In so small a genus, according to a well-known rule, we should require exceptionally good characters for the definition of species. But in order that the question may be finally settled, the observations of those who have an opportunity to compare the two forms in the feral state, are desired.

Botanical Notes.

The Herbarium of the late Isaac C. Martindale, of Camden, N. J., has, we are informed, been secured by the Philadelphia College of Pharmacy. This is another evidence of the rapid advance of modern pharmacy along sound, scientific lines. It will be recalled that the herbarium of Mr. Wm. M. Canby was purchased some months ago by the New York College of Pharmacy, and an account of it was at that time published in the BULLETIN. Although the Martindale collection is not nearly as extensive as the one secured by the New York institution, and the specimens are not nearly as fine nor as well named up, it is a most valuable accession to the teaching equipment of the Philadelphia college, whose officers are to be heartily congratulated on its acquisition. Mr. Martindale was a diligent student of the marine Algæ, and his herbarium is rich in specimens of these plants. The deposition of these two important private herbaria where they will be maintained and their growth continued in practical directions is an important occurrence in the history of Economic Botany. N. L. B.

New Plants in the Cayuga Flora. Scleria pauciflora Muhl.—While collecting about the West Junius marshes in August, 1893, I found this plant, which is not recorded in Dudley's Cayuga Flora. It seems to be rare in Central New York, and our station is probably on the northern limit of the species.

Trifolium arvense L.—During the same excursion, two other members of our party, Prof. W. W. Rowlee and Mr. H. Schrenk, discovered numerous specimens of this species growing along the roadside between the marshes and West Junius station. These marshes lie on a sandy ridge 6 miles north of Geneva, N. Y. The ridge constitutes the water-shed between the Seneca and Clyde River valleys. They are composed of three marl ponds and one peat pond surrounded by an extensive sphagnum meadow. West Junius is particularly interesting as constituting a portion of Dr. Sartwell's old collecting ground in Central New York, and the people in the neighborhood have very distinct recollections of his many botanical trips through that region.

Sparganium minimum Fries.—This species was collected by me in a sphagnum bog southeast of Chicago station, Cortland, N.

Y., in August, 1893. The Chicago bog lies 15 miles northeast of Ithaca, on the water-shed between the Cayuga Lake basin and he valley of the Susquehanna river. KARL M. WIEGAND.

BOTANICAL DEPARTMENT, CORNELL UNIVERSITY.

Notes and Queries.—During a short stay in Barre, Vermont, in the summer of 1893, I noticed two or three plants, not credited to that State in Gray's Manual, that may be of interest.

Epilobium strictum Muhl. was frequently seen, and seems well distributed over the State.

Fimbriaria tenella Nees. I found but once by a trout stream. Gray's Manual gives its range as "Central New York to Missouri and southward."

Mentha gentilis L. grows about many of the farm houses, and has sometimes wandered to the brook sides. I found it in abundance by a little run fully a quarter of a mile from a house.

Is Bazzania trilobata S. F. Gray, poisonous?—In the spring of '93 I had several tadpoles and earth worms in a fish globe. I fed them upon *Tillandsia usneoides*, upon which they seemed to thrive; after three weeks I threw in a bit of *Bazzania*, and in three hours all were dead. C. O. THURSTON.

WYOMING SEMINARY, KINGSTON, PA.

Scutellaria resinosa Torr.—If the description of the species given under this name in Dr. Gray's Synoptical Flora (p. 381) be compared with the references there cited, it will be found that they do not agree. The true *S. resinosa* of Torrey, collected during Long's First Expedition and published in the Annals of the New York Lyceum (**2**: 232) and by Bentham, in D.C. Prodr. (**12**: 427), is beyond question nothing else than *S. Wrightii* A. Gray, published long after (Feb. 1872) in the Proceedings of the American Academy. This is clear both from the descriptions and the type specimen in the Torrey Herbarium. It differs from the Colorado plant in its strong woody root, branching stems, round leaves, smaller flowers and shorter corolla-tubes. Its range extends from Kansas to Texas and thence westward to the Huachuca Mountains of Arizona. The other species is most common in the Rocky Mountains of Colorado and being thus deprived of the name *resinosa* I bestow on it that of SCUTELLARIA BRITTONII. THOS. C. PORTER.

Reviews and Notes on Literature.

The Study of the Biology of Ferns by the Collodion Method; for Advanced Collegiate Students. By Geo. F. Atkinson, Ph. B., Associate Professor of Crytogamic Botany; Cornell University, 8vo. pp. 134, 163 figures, New York. Macmillan & Co., 1894.

This book is designed for laboratory instruction and for reference on the development and structure of ferns. It consists of two parts; Part I. is descriptive and deals in full with the life history of ferns; Part II. deals with methods of study.

The descriptive portion of the work is arranged in seven chapters, six chapters being devoted to the leptosporangiate homosporous Filicineæ, and one chapter to the Ophioglosseæ. The chapters on the ferns trace in detail the development, morphology and anatomy of the gametophytic and sporophytic phases. The text is in no sense a compilation, but is written after a thoroughgoing and serious investigation by the author, using the collodion method as a means of bringing the material under contribution, so that in a very large measure it is written from nature revealed by original preparations. One unique feature of the work is the result of a critical examination by the author of the structure of the sporangium in the different orders of ferns and the dispersion of the spores. In the light of this study it is clearly shown that the customary statements regarding the extent of the annulus must be modified.

The illustrations are all original from camera lucida sketches, accompanied by a magnified micrometer scale, so that the reader can at once compute the magnification. All of the illustrations of sections are from objects prepared by the Collodion Method, and several of them from preparations made by students of the author during their ordinary laboratory work. The old method of free hand sectioning rendered it an extremely difficult task even for an expert to make satisfactory sections of the delicate prothalline tissue. The profuse illustrations in this book, representing as they do the entire range of development, the chief features of anatomy, and a comprehensive treatment of the structure of the sporangia of the different orders, are evidence of the comparative ease with which students may now, by this method, overcome obstacles which heretofore have stood in the way.

From the intermediate position which ferns occupy in the plant kingdom their life history presents a generalized view of the chief phenomena of plant life, and they are therefore admirably suited for studies of the biological aspect of botany, and form a suitable introduction to this phase of botanical instruction. The book is suited to assist students in laboratory classes in successfully tracing out the more difficult phases in the development of fern organs. The descriptive part affords a convenient means of reference at any step of the work, while the practical part deals with methods, preparation of material and instructions for prosecuting the various phases of the investigation, and is to be used as a laboratory guide. By its use, as first tested by the author in his own classes, the students are enabled to make with precision and accuracy permanent microscopic preparations of all the stages of development. Especial success has been had in adapting the collodion method to the handling of the delicate prothalline tissue, sexual organs and embryo, it being better suited to such delicate tissue than the paraffine method, and the preparation of material can be carried through in less time and with far less trouble. Permanent microscopic sections thus made serve the purpose of study for future reference, and, if desired, for class illustration.

The descriptive part occupies such a prominent part of the book that it will commend itself also to those who do not contemplate the practical study, but desire in compact form a much fuller account of fern history than can be obtained in ordinary text-books.

Manual of the Botany of the Region of San Francisco Bay, being a Systematic Arrangement of the higher Plants growing spontaneously in the Counties of Marin, Sonoma, Napa, Solano, Contra Costa, Alameda, Santa Clara, San Mateo and San Francisco, in the State of California. Edward Lee Greene. (8vo., pp. 328, Cubery & Co., San Francisco, 2 Feb., 1894).

Descriptive local floras are altogether too few, and are consequently very welcome, and if produced as the one which lies before us after an exhaustive study during many years of the plants themselves in the field and laboratory, cannot fail to have a lasting effect on the botany not alone of the area they cover, but of the world. The volume here reviewed is essentially an original piece of work. One sees at once by an inspection of its pages that the author has not been content to accept the dictum of previous writers, but that his descriptions have been drawn from his own material and his conclusions reached from his own observations. The great value of this kind of work is obvious, for it presents an entirely new conception of the subject matter.

Departing from the sequence of orders taken up by him in the Flora Franciscana Professor Greene now adopts with slight modifications the arrangement as outlined in Baron von Mueller's last edition of the "Census of Australian Plants," placing the Choripetelæ Hypogynæ as the first division of the Dicotyledons and ending with Monocotyledons, of which sub-class only the orders Orchidaceæ, Iridaceæ and Liliaceæ are taken up, the lower orders being excluded on the statement that "a number of genera and species much greater than the beginner may master in one season's work, or in three," are included in the ninety orders treated. Professor Greene evidently does not accord much value to the modern notion of proceeding from the simple to the complex; perhaps for the purpose for which his Manual has been written for "persons desiring to make some beginnings in the systematic botany of Middle California" the arrangement adopted is as good as anything.

A considerable number of new species are proposed, and many new views advanced on the limitations of genera, especially in the order Compositæ, tending principally to maintaining more genera than have recently been recognized. Several of these are proposed as new. The descriptions are concise, clearly written and well contrasted. Keys to the genera are given for each order and the statements of the more characteristic features of the species are set in italic type. Professor Greene questions the wisdom of this in his preface, remarking on the temptation it offers to students to pass over all the descriptive matter except the keys and the italicised words. In our opinion it is advantageous despite the objection cited against it.

In nomenclature the maintenance of the oldest specific name has been consistently followed, and the first author cited in parentheses. The author has carried out his long-cherished plan of taking up a large number of pre-Linnæan genera, going so far this time as to use some not adopted by Linnæus. He says of this position that he "is convinced that the day is coming, and with a fair rate of speed, when the employing generic names which Linnæus substituted for older ones, instead of such as have right of real priority, will no longer be thought of by those who name priority as a leading principle in plant nomenclature." In this he may be correct, but we must say that the expressions of botanists all over the world, during the past few years, appears to us to indicate that the point of departure for biological nomenclature is becoming more and more firmly fixed at the Linnæan time.

The book is handsomely printed, typographical errors are few and must prove, to those who will use it in its own area, in the words of the author "indispensable, at least until some worthier treatise shall take its place," an event which we do not anticipate observing in the near future. N. L. B.

Juncus marginatus and its Varieties. Frederick V. Coville (Proc. Biol. Soc. Washington, **8**: 121–128, 1893).

After an exhaustive study of this species as represented in the larger American herbaria, Mr. Coville groups the forms under *J. marginatus* type, which ranges from Maine and Ontario to Florida and Missouri; *J. marginatus aristulatus* (*J. aristulatus* Michx., *J. biflorus* Ell.) occurring from Southern New York to Florida, west through the Gulf States to Texas, and northward in the Mississippi Valley to Michigan, and found also in Guatemala and Brazil, and *Juncus marginatus setosus*, a new variety, occurring from Kansas and Nebraska to Arizona and Mexico; *aristulatus* is stated to exhibit a full series of intergrades with the type; in *setosus* the full intergradation was not observed.

The treatment of these forms made by Mr. Coville is a capital illustration of one method of disposing of them. Another method would be to regard them all as species. N. L. B.

Annual Reports of the State Botanist of the State of New York. Charles H. Peck (from the 45th and 46th Reports of the New York State Museum of Natural History, pamphlets, pp. 42 and 69, Albany, 1893).

Mr. Peck's annual reports for 1891 and 1892 appeared in close succession during the autumn of 1893. The form of his previous reports is preserved, giving general notes on the work of his department, a list of plants added to the State herbarium, a list of contributors and their contributions, notes on plants not before reported by him as occurring within the State, and remarks and observations on various species, under which heading in both reports a large number of fungi are described as new species.

Monographs of the New York species of *Omphalea*, *Pluteola* and *Galera* are appended. N. L. B.

Abutilon vitifolium. J. D. Hooker (Bot. Mag. *t. 7328*, December, 1893).

Illustration and description of this fine Chilian species.

Neue Asiatische und Amerikanische Gentianien. N. J. Kusenow (Act. Hort. Petrop. **13**: 52–64, 1893).

Four new species of American Gentians are here described as new—*G. scaberrima*, said to be related to *G. Saponaria* and *G. Elliottii*, and which appears from the description to be a narrow-leaved form of the latter, *G. Grayi*, based on a specimen collected by H. C. Beardslee in Michigan and labelled *G. puberula* and said to resemble both *G. puberula* and *G. linearis*, and which we do not satisfactorilly refer to any species known to us; if any one in America possesses a duplicate of this collection we should be glad to see it; also *G. Californica* from California and *G. ovatiloba* from Mexico (Bourgeau, No. 1123 bis.). N. L. B.

Proceedings of the Club.

WEDNESDAY EVENING, FEBRUARY 28, 1894.

The President in the chair and fourteen persons present.

Mrs. Britton announced the death of Dr. Richard Spruce, one of our corresponding members and a botanist of distinction. Dr. Spruce was connected with the work of collecting plants and seeds of the *Cinchona* trees for introduction to culture in British India. At this time and subsequently, he made great collections of plants in Peru and upon the upper Amazon, and he has been for many years widely known as an able student of Cryptogams, especially Hepatics. He was an old man and had been for a long time in very poor health. Dr. Britton announced the death of another corresponding member, Dr. Samuel Lockwood, of Freehold, New Jersey. The two announcements were discussed by several members, and, by a vote of the Club, the Secretary was requested to address a letter of condolence to the family of Dr. Lockwood, who was personally known to many of the members.

The announced paper of the evening was then read by Dr. Rusby, "New Species of Gamopetalæ from Bolivia." The paper consisted of brief general references to the principal species-yielding groups, and was illustrated by specimens. It will be published in the MEMOIRS.

TUESDAY EVENING, MARCH 13, 1894.

The President in the chair and twenty-four persons present.

Mr. Wm. M. Van Sickle and Miss Alexandrina Taylor were elected active members.

The Secretary read a communication from Mr. A. Commons, of Wilmington, Del., recording the occurrence of *Meibomia ochroleuca* and *Elephantopus Carolinianus*, near Pennsville, Salem county, N. J., both new to the Flora of that State.

The announced paper of the evening was read by Mr. Henry Kraemer, entitled "Botany at the World's Columbian Exposition." It was discussed by Dr. Britton, Mr. Lebrun and the President.

WEDNESDAY EVENING, MARCH 28, 1894.

Vice-President Allen in the Chair and twenty-eight persons present.

The Committee of Instruction reported that the circulars relating to the course of 1894 had been distributed, and that, in accordance with the resolution of last year to extend the course to fifteen lectures, the course had already commenced with a lecture last Thursday.

It was resolved that the President be requested to appoint a Field Committee of five members to act during the ensuing season. The President subsequently appointed as this Committee, Dr. H. H. Rusby, chairman, Mrs. N. L. Britton, Miss Helen Ingersoll, Mr. Geo D. Hulst and Mr. T. H. Kearney, Jr.

Mr. G. T. Rignel, of Lockport, N. Y., was elected a corresponding member.

Dr. Britton alluded to the so-called *Rhamnus Caroliniana* of the vicinity of New York, and stated that on investigation it had been proved to be a different species which appeared to be undescribed in American books. Specimens were exhibited from New Durham, N. J., East New York, and Flushing, Long Island.

The following announced papers were presented:

"The Early Botanists," by Dr. S. Ely Jelliffe.

"The Species of *Orthotrichum* of Western North America," by Mrs. N. L. Britton. (Published in the present issue of the BULLETIN.)

Index to Recent Literature relating to American Botany.

Atkinson, George F. Heliotropism of *Cassia nictitans.* Bull. Torr. Bot. Club, **21**: 81. 20 F. 1894.

Bailey, L. H. The Japanese Plums in North America. Bull. N. Y. (Cornell.) Exp. Sta. 62, 36. Ja. 1894.

Maintains that "the Japanese plums constitute the most important type of fruit introduced into North America during the last quarter of a century."

Bailey, L. H. Whence came the Cultivated Strawberry? Am. Nat. **28**: 293–306. Ap. 1894.

Baker, J. G. *Hippeastrum brachyandrum.* Curt. Bot. Mag. 50: *t. 7344.* Mr. 1894.

A Paraguayan species.

Bay, J. Christian. The Micro-organisms of Fermentation. Am. Nat. **28**: 343. Ap. 1894.

Bay, J. Christian. Vegetable Ferments. Bot. Gaz. **19**: 68–71. Mr. 1894 [reprinted].

Beach, S. A. Strawberry Crosses. Bull. N. Y. (Geneva) Exp. Sta. 64, pp. 8, *pl. 2.* Ja. 1894.

Beech, S. A. Experiments in preventing Pear Scab. Bull. N. Y. (Geneva) Exp. Sta. 67, 181–204, *pl. 2.* F. 1894.

The treatment was successful with dilute Bordeaux mixture.

Benson, Margaret. Contributions to the Embryology of the Amentiferæ.—I. Trans. Linn. Soc. London, 3: 409–424, *pl. 67–72*. F. 1894.

Bescherelle, Em. Musci Guadalupensis. Journn. de Bot. **8**: 61. 1 F. 1894.

Descriptions of four new species under *Barbula*, *Bryum*, *Pterobryum* and *Lepidopilum.*

Bessey, Charles E. Holophytes and Hysterophytes. Am. Nat. **28**: 343. Ap. 1894.

Blochman, Ida M. Californian Herb-lore—IV. Erythea, **2**: 39, 40. 1 Mr. 1894.

Bolley, H. L. Typhoid Fever. Bull. N. Dak. Exp. Sta. 13, 27–31, *f. 1.* 1 Ap. 1894.

Britton, Elizabeth G. Contribution to American Bryology.—V. Notes on the North American Species of *Weissia* (*Ulota*). Bull. Torr. Bot. Club, **21**: 65–76. 20 F. 1894.

Britton, N. L. Note on the Herbarium of Stephen Elliott. Bull. Torr. Bot. Club, **21**: 80, 81. 20 F. 1894.

Conn, H. W. The Ripening of Cream by artificial Bacteria Cultures. Bull. Conn. (Storrs) Exp. Sta. 12, 20. F. 1894.

Pure cultures of the species of bacteria producing the best flavors in butter can be furnished to the creameries by bacteriologists.

Coville, Frederick Vernon. *Ostrya Knowltoni*, a new Species of Hop Hornbeam. Gard. & For. **7**: 114, 23. 21 Mr. 1894.

From the Grand Cañon of the Colorado.

Coville, Frederick Vernon. Proposed Seed Collection of U. S. National Herbarium. Bot. Gaz. **19**: 121. 16 Mr. 1894.

Davis, Bradley Moore. Contributions from the Cryptogamic Laboratory of Harvard University.—XXIII. Notes on the Life History of a blue-green motile Cell. Bot. Gaz. **19**: 96–102, *pl. 11.* 16 Mr. 1894.

Notes on *Cryptoglena Americana* sp. nov., which the author suggests may be the motile form of *Polycystis pallida.*

Davy, J. Burtt. Some Citations needing Correction. Erythea, **2**: 48–51. 1 Mr. 1894.

Dewevre, A. Contribution a l'Etude des Mucorinées. Grev. **22**: 69–76. Mr. 1894.

Descriptions and synonymy of the species of *Pilobolus.* No reference is made to the occurrence of any of the species as American, but several are well known.

Durand, Elias J. Some rare Myxomycetes of Central New York, with Notes on the Germination of *Enteridium Rozeanum*. Bot. Gaz. **19**: 89–95, *pl. 9, 10*. 16 Mr. 1894.

Notes and fuller descriptions of *Arcyria macrospora* Pk., *Cribraria purpurea* Schrader, and *Trichia erecta* Rex.

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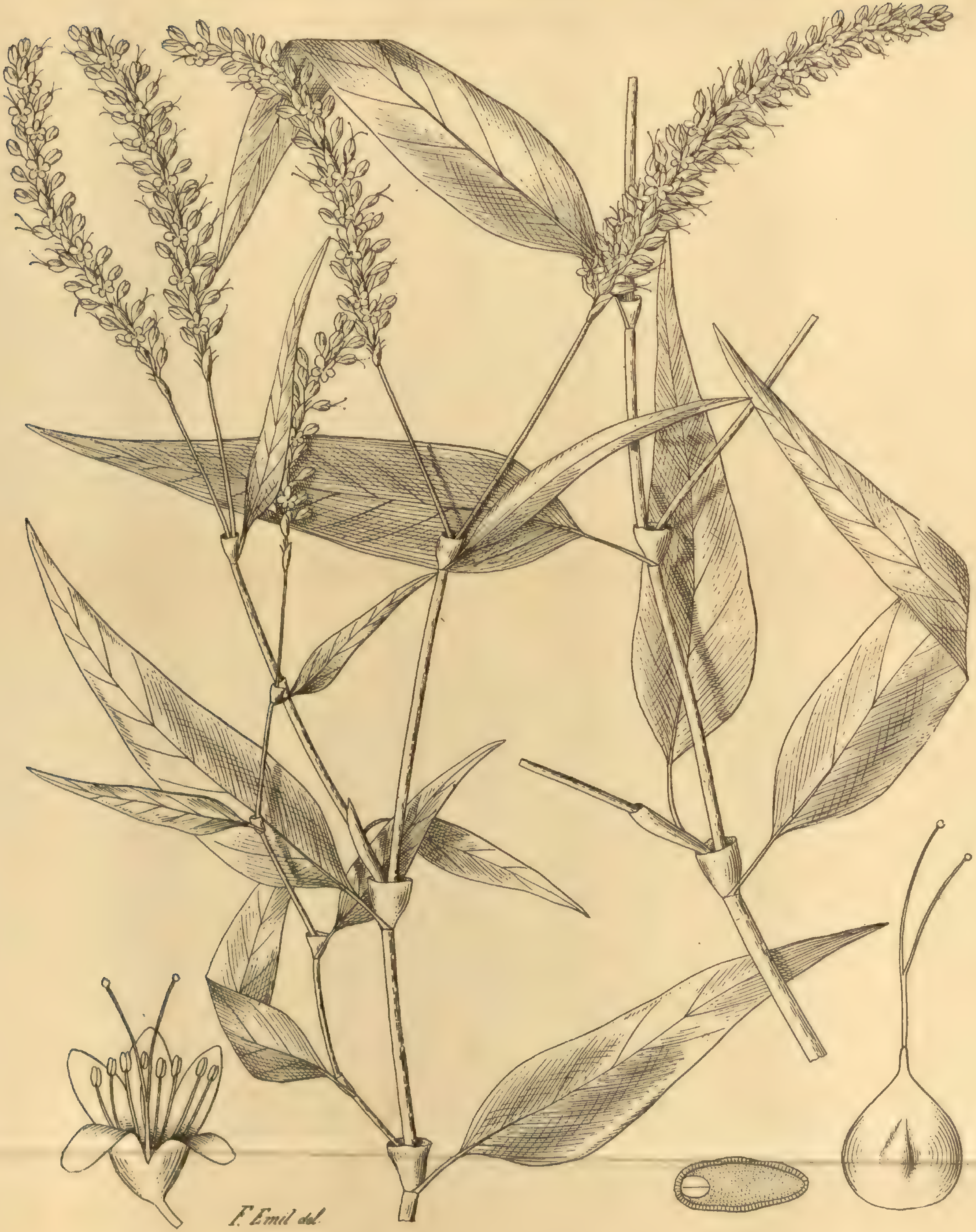

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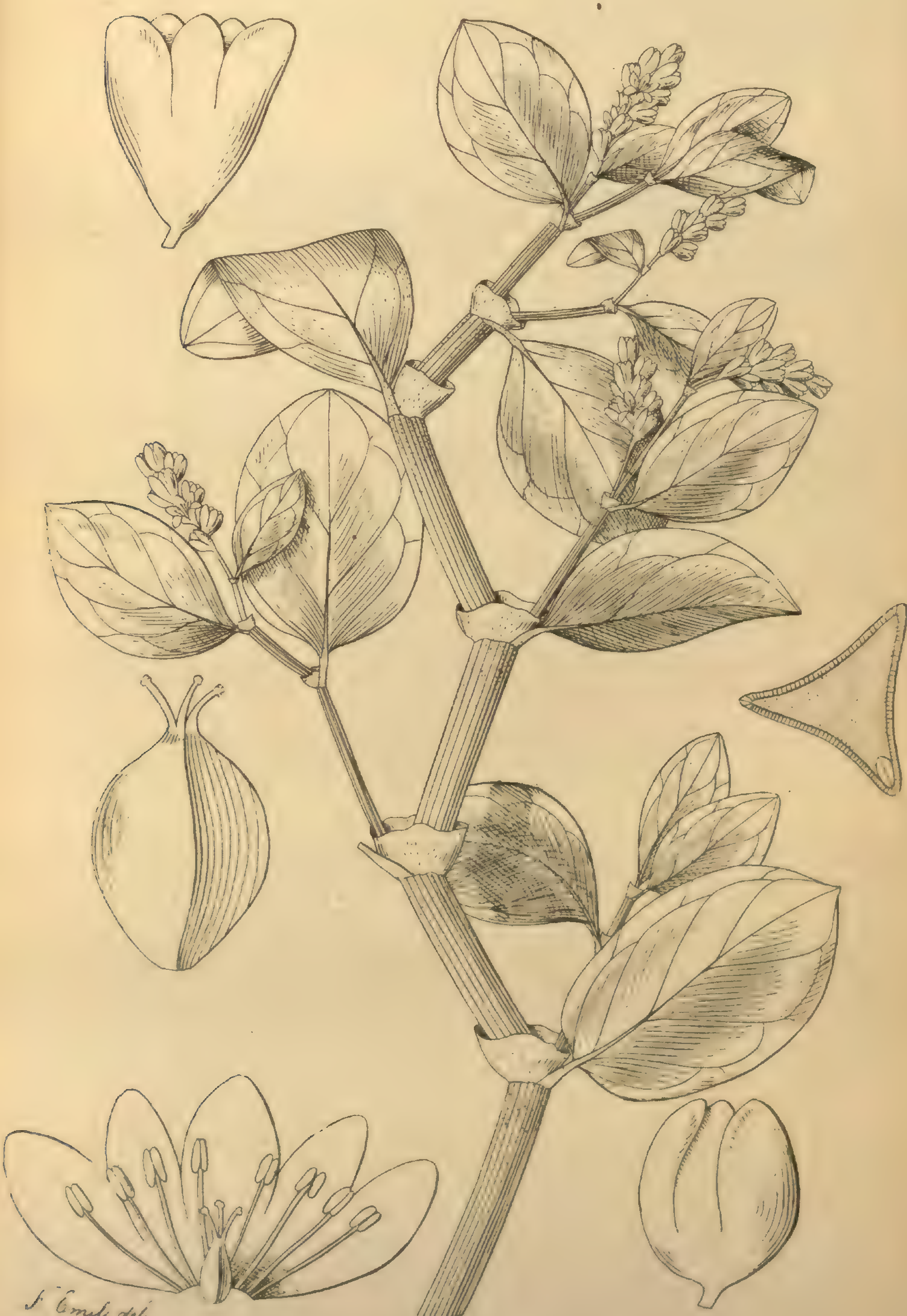

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CONTENTS:

PAGE.

Contributions to American Bryology—VII. A Revision of the Genus *Physcomitrium* with Descriptions of five new Species: *Elizabeth G. Britton* (PLATES 197–203) 189

The Genus *Cassia* in North America: *Charles Louis Pollard* 208

Steps towards a Revision of the linosporous Species of North American graminicolous Hypocreaceæ: *George F. Atkinson* . . 222

Teratological Notes: *Hermann Schrenk* (PLATE 204) 226

Three new or noteworthy Grasses: *F. Lamson-Scribner* (illustrated) 228

PAGE.

Death of Dr. Thomas Morong 230

BOTANICAL NOTES.—Systematic Botany of North America; *Cratægus punctata canescens*, n. var. 230

REVIEWS.—Fossil Cycadean Trunks of North America with a Revision of the Genus *Cycadeoidea;* Annotated List of the Fossil Plants of the Bozeman, Montana, Coal Field

PROCEEDINGS OF THE CLUB 232

INDEX TO RECENT LITERATURE RELATING TO AMERICAN BOTANY 234

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Vol. 21. Lancaster, Pa., May 25, 1894. No. 5.

Contributions to American Bryology.—VII.

BY ELIZABETH G. BRITTON.

A REVISION OF THE GENUS PHYSCOMITRIUM, WITH DESCRIPTIONS OF FIVE NEW SPECIES.

(PLATES 197–203.)

When Sullivant's Mosses of the United States was published in 1856 he recognized three species in this genus, two with European names, one of which has since been referred to *Pyramidula;* the third, *P. immersum*, having gone through the transitional stage of bearing a European name which did not belong to it, by being distributed as *P. sphæricum* in Sullivant's Musci Alleghanienses.

We think as much harm may be done, however, by referring well-known species to old disused names as by adopting European names without comparing specimens, and therefore it has been attempted in this contribution to see the originals in all cases.

The Manual of mosses of North America describes six species. The first, *P. immersum* Sull., is clearly defined and understood. The second, *P. pygmæum* James, has only been collected once, is poorly described, and the only fragments of it preserved in Sullivant's herbarium are a slide and a drawing. The third, *P. pyriforme* (L.) Brid., is a European species, the typical form of which does not occur in America. In a footnote several American varieties are briefly described. The fourth, *P. Hookeri* Hpe., is correctly understood, and the name has the right of priority, but the first synonym given belongs to the last species. The fifth, *P. acumin-*

atum (Schleich.) Br. & Sch., may be said also to be correctly understood, though from the localities cited it is probable that two species are included in the description. The sixth, *P. turbinatum* Müller, is a duplication of names not intended by Müller, and should replace *P. pyriforme* for the American forms of this variable species.

Since the publication of the Manual, three other species have been described from Macoun's collections by Kindberg, *P. megalocarpum*, *P. strangulatum*, and *P. platyphyllum*. The first will stand for the large Western forms of what we have been calling *P. pyriforme*, the second is a synonym of *P. turbinatum*, and the third is described from such very immature specimens that it will also probably not stand, though Prof. Macoun and Mr. Fletcher owe it to students to follow this species up, and collect, if possible, more and better specimens.

Five other well-defined species are described and figured in this contribution, and more specimens from the West and South are desired.

PHYSCOMITRIUM IMMERSUM Sull. in A. Gray, Man. Ed. 2, 651 (1856); Icones, 93, *t. 56* (1864).

P. sphæricum var? Sull. Musci. Alleghen. No. 196. (1848).

This species is the only one of the genus which matures its capsules in the fall, and is liable to be mistaken for *Aphanorhegma serrata*, which it closely resembles. The Manual says it "differs merely in the inflorescence, the dehiscence of the lid, and the leaves more distinctly serrate by yellowish cells." The splitting of the capsule exactly in the middle and the thickening of the angles of its cells sufficiently distinguish *Aphanorhegma*, whereas the annulus and border of 2–3 rows of denser transversely elongated cells of the capsule in *P. immersum* shows its alliance with the genus to which it has been referred.

Type locality: "River banks, Southern Ohio, Lea." It has also been collected in Western Pennsylvania, by Lesquereux; on the banks of the Allegheny river, by D. A. Burnett; of the Susquehanna, by J. K. Small; along the Delaware at Camden and Philadelphia, by T. P. James and C. F. Austin; along tidal ditch banks at Wilmington, Delaware, by A. Commons; at Albany, New York, by C. H. Peck; on sandy clay bank of the Mississippi river, at Winona, Minn., by J. M. Holzinger; in a dry slough in Saline county, Missouri, by C. H. Demetrio; Colorado, Wolf & Rothrock, 1873; South Carolina, Ravenel; on inundated alluvial soil (in small tufts) along the outlet of Leamy's Lake, near Hull, Quebec, October 4, 1889, Macoun.

Exsiccatæ: Sull. Musci. All., No. 196; S. & L., Musci Bor. Am. Ed. II., No. 233; Austin Musci App., No. 179.

PHYSCOMITRIUM PYGMÆUM James, Bot. King's Exp. 404 (1871). L. & J. Manual, 197 (1884.)

(Plate 197, from original drawings by Sullivant.)

Plants small, 3–5 mm. high; stems leafy, simple or sparingly branched; leaves longest at apex, oblong acuminate, serrulate, vein ending in or below the apex; seta short, almost immersed, twisted to the left, as long as the oblong-pyriform capsule; annulus of two rows of narrow cells, persistent; mouth bordered by 5–7 rows of oblong cells; neck tapering with few stomata; lid large, conic apiculate; calyptra lobed and beaked, spores rough, .028–.031 mm., maturing?

Utah, Watson, 1869; not collected since. Only fragments are preserved in Sullivant's herbarium.

Type locality: "On the ground above Parley's Park, in the Wahsatch mountains, Utah, at 6,500 feet altitude, Watson; a few imperfect specimens."

The description given of this species in the Manual is misleading, as the plants are compared with both *P. immersum* and *P. Hookeri*, and it is not stated whether the capsules are immersed or exserted. The printer has also increased the confusion by transposing the phrase "marginal cells transversely oblong, in 5–7 rows," to apply to the leaves, whereas it refers to the mouth of the capsule.

The following description was sent to us by Dr. B. L. Robinson from Sullivant's herbarium, with the original drawing made by Sullivant, which we have been permitted to copy and reproduce:

"109. PHYSCOMITRIUM PYGMÆUM, Sp. Nov.

"Plantæ generis minima, a *Physcomitio pyriformi* distat exiquitate foliis minus distincte serratis; capsula oblonga-pyriforme cellulis marginalibus transverse oblongis in seriebus 5–7 (nec 12–15) dispositis instructa basi paucius stomatifera; operculo longiore; pedicello toto sinistrorsam torto," etc.

"The shape of the capsule with its adherent annulus readily distinguishes this species from *Physcomitrium hians*, Lindb."

PHYSCOMITRIUM PYRIFORME (L.) Brid. Bryol. Univ. **2**: 815 (1827).
Bryum pyriforme L. Sp. Pl. 1580 (1753).

Gymnostomum Physcomitrium pyriforme Brid. Bryol. Univ. **1**: 98 (1826); also of all subsequent European authors, not American.

We have in the Jaeger and Torrey herbarium specimens of this species from all parts of Europe. The first and most striking difference observed between European and American specimens is the uniform length of the pedicels in the former and the regular, more pyriform capsules, which are larger than the American specimens and dry more uniformly in shape and color; the lid also is flat, the beak longer and more sharply apiculate when dry; the neck is shorter and less contracted below the spore-sac when dry, and the capsules are none of them as conspicuously constricted below the mouth as in our specimens. Even from macroscopic differences the species seem to be distinct, but when we examine the mouth of the capsules we find that the annulus is more highly differentiated in European specimens, being double, and falling in fragments with the lid, while in American specimens it is single and persistent, composed of a narrow row of orange-colored cells with the second row of hyaline vesicular cells bent in after the falling of the lid. The walls of the capsules, too, are different; in European specimens the cells are lax and indistinct, in American they are regular and very clearly outlined by their thick cell walls. Those around the mouth are seldom more than 12 rows, usually 8–12, whereas Limpricht says of the European, 8–16.

PHYSCOMITRIUM TURBINATUM (Michx.) Brid. Bryol. Univ. **2**: 815 (1827).

Gymnostomum turbinatum Michx. Fl. Bor. Am. **2**: 286 (1803).
Gymnostomum dilatatum Beauv. Prod. 59 (1805).
Gymnostomum splachnoideum Beauv. Prod. 59 (1805).
Gym. Physcomitrium tortipes Brid. Bryol. Univ. **1**: 100 (1826).
Physcomitrium turbinatum Mueller; L. & J. Man., 198 (1884).
Physcomitrium pyriforme, not Brid. of American authors.

On consulting the original descriptions of the above references it will be seen that in all cases but the last they were based on American specimens by European authors and indicate a difference in comparison with the European *P. pyriforme*. They also indicate the variability of the American species, though the variations are not constant enough to be specific, and hardly sufficient for varietal rank. For the sake of the argument the original descriptions are quoted:

Gymnostomum turbinatum Michx.

"G. brevicaule simplex: foliis lanceolatis, apiculatis, serrulatis sporangio oblongiuscule turbinato; operculo convexo, submamillato.

"Habitus et magnitudo *G. pyriformis;* pedunculo longiore; sporangio excusso operculo magis truncato minusque crasso.

"Hab. in Carolina inferiore."

"*Gym. dilatatum* Beauv. Caule simplici erecto foliis spathulatis apici serrulatis, pyxidis pyriformis orificio magno, patulo."

"Amerique Septentrionale."

"J. 'ai rapporte cette espece des Etats-Unis d'Amerique (Caroline du Sud), elle est remarquable par l'orifice large et trés-ouvert de l'urne; du reste elle a le porte du *Gym. pyriforme.* Elle croit dans les lieux inondés."

"*Gym. splachnoideum* Beauv. caule simplici erecto; foliis ovato lanceolatis, serrato-dentatis, acuminatis, costa integra notatis, pyxidibus oblongis." Amerique septentrionale.

"Je l'ai trouvée dans le nouveau Jersey: elle differe du *Gym. pyriforme* par la forme de l'urne, qui est comme ètranglée au milieu."

"*Gymnostomum Physcomitrium tortipes* (Bernh. Brid.) caule erecto simplici, foliis ovato-lanceolatis concavis strictis subpatentibus, pedunculo gracili flexuosissimo, thecæ turbinatæ superne coarctatæ operculo umbonata."

In America septentrionali circa Philadelphiam habitat. Clar. Bernhardi communicavit.

"Specie, ut videtur, distinctum a *G. turbinato*, quod thecæ forma æmulatur, pedunculo nullatenus crasso stricto, sed valde flexuoso, præsertim in statu sicco ita ut theca nutet, unciale, longiore. A *splachnoideo* autem differt theca non in medio sed apice coarctata, ut et pedunculis duplo longioribus, gracilioribus, contortis; ab utroque tandem foliis strictis, aqua sese pulchre explicantibus. Rete vasculosum etiam diversum.

Through the kindness of M. Bescherelle and M. Franchet, I have been permitted to examine Michaux's types of *Gymnostomum turbinatum.* Three specimens were sent to me from Richard's herbarium in the Musée d' Histoire Naturelle at the Jardin des Plantes. They were collected by Michaux, and are undoubtedly the specimens from which the description was drawn. They represent different specimens from different habitats, as they are not all in the same stage of development, but they show the same variations that other North American specimens do. Several of the plants are larger than the average, 15–25mm. high, the stems short and simple or branching, several are 15mm. high with more than one capsule on a plant. They are particularly noticeable for the different lengths of the pedicels, for the turbinate capsules, and the blunt lids, all of which points Richard recognized as different from the European species.

I have not seen the types of the two species described by Beauvois, but from the descriptions I do not think there is any doubt that they all refer to one very variable species.

Dr. Torrey corresponded with and sent specimens to Bridel, and I find in his herbarium four specimens numbered and named presumably by Bridel, as follows:

11. *Gymnostomum pyriforme*, without locality, presumably American.

29–30. *Gymnostomum turbinatum*, collected by Schweinitz.

31. *Gymnostomum splachnoideum*, from Canada.

They are all referable to *P. turbinatum*. It will be remembered that as late as 1826 Bridel, in the Bryologia Universalis, maintained three American species as distinct from *P. pyriforme*.

Physcomitrium turbinatum Müller, ined. L. & J. Man. 198 (1884).

G. turbinatum Michx. is given as a synonym of *P. Hookeri* in the Manual, but this is evidently a mistake. Lower down on the same page *P. turbinatum* Müller, ined., is described as a species, thus duplicating a specific name in one genus, and confusing the synonymy. In order to settle the doubts raised by this mixture, I wrote to Paris, and M. Bescherelle sent me a portion of Boll's Texan specimens from the herbarium of C. Müller, these being the ones from which the description of *P. turbinatum* in the Manual was drawn. In his reply, dated May 1, 1893, Bescherelle says: "Quant au *Physc. turbinatum* du Texas (Boll legit) attribué par Lesquereux et James a C. Müller, je ferais remarque que Müller me l' a envoye sans nom d' auteur, dans la pensee que je n' ignorais pas que cette espece etait celle de Bridel, Michaux, Richard, autrement il n' aurais negligé de mettre son nom a la suite du nom specifique, comme il le fait toujours."

I had already suspected that this might be the case, and had written to Müller asking him whether he intended to make a new species or refer Boll's specimens to *G. turbinatum* Michx. He returned my letter annotated, and in reply to the above question says, "Ad hancce speciem" (to this very species). T. Boll's specimens collected in Dallas County, Texas, are represented in our herbarium by three packets, one received from M. E. Bescherelle, ex herb. Müller, and two from the Jaeger herbarium. One of these is an autograph specimen from Müller labeled "*Physcomitrium pyriforme* var. *turbinatum*," and the other was found in a package of unnamed mosses collected by Boll, sent by Müller to Dr. Jaeger. The plants all agree, as the Manual says, in being "cæspitose" and "much divided," some of the stems are 25 mm. long, and branch three times. The leaves are distinctly acuminate, but the vein is not excurrent, and the margins are distinctly serrate above the middle, not "entire at apex." In my letter to C. Müller I asked about this point, and he says "apice grosse serrata." In the footnote in the Manual the leaves are said to be entire at the apex or nearly so, which seems a strange mistake to make, as they had authentic specimens; the capsule, too, is said to be without a "collum," but Müller says, "Non sed collum apophysatum adest." Our specimens show the neck wrinkled and contracted below the spore-sac when dry, and stomatose. The capsules are rather large, nearly 2 mm. long, lid flat and blunt, seta 10–15 mm. long, the mouth bordered by twelve rows of transversely elongated cells, and quite flaring when dry. The longest leaves are 4 mm. long, and the resemblance of the plants to the lax forms distributed by Sull. & Lesq. Musci Bor. Am. Ed. II. No. 234, as *P. pyriforme* is very close. They evidently grew in a damp muddy place. Similar specimens were collected by L. M. Underwood at Orange Bend, Fla., by Parker at Camden, N. J., and at Fort Edward, N. Y., by E. C. Howe. We have specimens from the vicinity of New York City, grown in wet places, which are much taller and more lax than the form from dry fields.

Kindberg has been struggling with the same difficulty in studying Macoun's mosses, and has also succeeded in making another synonym, which is very suggestive of the most conspicuous characteristic of our North American species. In the Ottawa Naturalist (4: 62, 1889) he described *P. strangulatum* Kindb., which later, in Macoun's Catalogue (Part 6: 103, 1892) is referred to *P. turbinatum* C. M. (L. & J. Man. 198). The specimens from both localities cited in the catalogue have been sent to me by Prof. Macoun, mixed together in one packet, so that I cannot tell from which locality the large lax ones, which match Boll's Texan specimens, were collected, but they are correctly referred to "*P. turbinatum* Müller," probably by Müller himself, who has recently been verifying some of Kindberg's determinations.

P. platyphyllum Kindb. Macoun's Cat., Part 6, 269 (1892).

We have tried to get good specimens of this species, but neither Prof. Macoun nor Mr. Fletcher have any but immature specimens, and from the description it seems evident that the types also were "unripe." Prof. Macoun kindly sent us all he had, and we have compared them with all the immature specimens of *P. turbinatum* in our collection and have been forced to the conclusion that this must also rank among the synonyms of that species.

We have no desire to suppress or supplant any well-established new species, but cannot adopt a name, and refer other specimens to it, when it is impossible to say that we are sure we should recognize it again. These specimens of *P. platyphyllum* have no character. They are too young to show the mature shape of the capsule, or the lid, or the size of the spores, and deserve to be relegated to the limbo of uncertainty, but as so few specimens of *P. turbinatum* have been collected in Canada it may incite others to gather specimens whenever they see them, hence the following amended description is given:

Physcomitrium platyphyllum Kindb.; Macoun's Cat. Part 6, 269 (1892).

Plants gregarious, stems simple or branched at base; leaves sublingulate, 2–3 mm. long, serrate above the middle, upper very broad ovate-acuminate, indistinctly margined; vein percurrent or ending below the apex; cells wide subhexagonal, the basal subrectangular. Seta 5–10 mm. long, stout, pale yellow, bent; capsule too immature to see the ultimate shape; lid conic, blunt; calyptra 7–8 lobed; mouth bordered by 8–10 rows of cells, annulus orange-colored, with a vesicular row bent inward; spores immature.

On earth in the streets of Ottawa, Ontario, Fletcher. Differs from *P. turbinatum* in the broader leaves? Macoun's number 597 Canadian mosses was distributed as *P. pyriforme*, from two localities, Windsor and Sandwich, Ontario, May 24, 1892. It contains two species, growing together, *P. turbinatum*, a small slender form, scarcely mature, and *P. Drummondii*, a few large, ripe capsules, with much thicker pedicels, and dark brown in color.

If we turn to Renauld and Cardot Musci Americæ Septentrionalis, p. 31, we shall find that we have another tangle of new names and old ones to deal with. Thanks to the generosity of M. Cardot, I have been favored with authentic specimens of all his types of this genus and have been able to make some very interesting comparisons and corrections. Their check-list enumerates *P. pyriforme*, Brid., as an American species, and after calling his attention to my views, M. Cardot still maintains that it is, and sends me a portion of his set, S. & L. Musci bor. Am., Ed. II., No. 234, as an example. I have compared his and ours with European specimens and am still forced to differ from him, for reasons already stated.

Three varieties are listed:

"Var. *tortipes* (Brid.) Sine loco." The specimens referred to in the Manual under this name are Drummond's No. 25 from Apalachicola, Fla., though this is probably not the form so named by Bridel, whose specimens came from Pennsylvania.

"Var. *floridanum*, R. & C. A forma typica foliis longioribus longius acuminatis, magis serratis capsulaque ore valde dilatato, vacua cupuliforma, diversa."

We presume he means by "forma typica" the European species. In a letter received October 18, 1893, he sends me this variety as equal to *P. turbinatum*, admitting my conclusion as far as these specimens are concerned and dropping this varietal name.

"Var. *Langloisii*, R. & C. Bot. Gaz. 94, 1889, N. J., La."

We have examined the specimens collected by Langlois and authenticated specimens from Cardot. They are unlike any Northern specimens in their long, slender pedicels, narrow, turbinate, almost campanulate capsules, and pale yellow color. We have it from several other Southern localities and collectors, and it maintains its individuality. We also have the specimens collected at Atco, New Jersey, by H. A. Green, which have also been referred by the authors to this variety, and some specimens collected in the vicinity of New York from wet localities, were so named by M. Cardot. We regret that he should not have maintained this varietal name for the lax, pale, slender, Southern form, from which it was originally named, and not extended it to include all our taller Northern ones, which are not at all constant, and are dependent on exposure, soil and moisture.

We are inclined to think that var. *Langloisii* is almost worthy of specific rank, and have figured it in order to call attention to it, and obtain more material.

P. Hookeri var. *serratum*, R. & C. "A forma typica foliis dimidio superiore grosse et obtuse serratis distincta."

We have received from both Cardot and Henderson duplicates of the specimens on which the above variety was based. We cannot find the well differentiated annulus so characteristic of *P. Hookeri*, and have since discovered that they are identical with the specimens we sent to M. Cardot under two manuscript names from two localities; the first collected by Langlois in Louisiana, was named for that state, and the second collected by Jermy in Texas was named for that state. Further comparison and study have convinced me that all three are identical with the specimens collected by Drummond near New Orleans and distributed in 1848 as *P. pyriforme*, var. 3, No 24, of his Southern mosses. We have named it PHYSCOMITRIUM DRUMMONDII, after the original collector, and rejected both our own manuscript names, as the species is found to have a much wider range than we at first supposed.

We wrote to M. Cardot, giving him our views on the differences between the European *P. pyriforme* and the American *P. turbinatum*, and at the same time calling his attention to the fact that his var. *serratum* could not be referred to *P. Hookeri*, on account of its simple annulus. He admitted the correction, and transferred it to the American species, as *P. turbinatum*, var. *crassipes*, m. s. This name has not been published, though we have given him abundant time to do so, as it is over six months since our correspondence on this subject. We would have adopted his name, which is very appropriate, in reference to the thick pedicel, if M. Cardot had taken the trouble to compare all the specimens as I have done, and had then recognized its claim to specific rank, but we question his right to coin another varietal name for one already printed, even though the first name, *serratum*, was less suitable under the new species to which he referred it than under the old, and we also disagree with the second specific determination, as the capsules have only 5–7 rows of cells around the mouth; the lid is apiculate, and the spores are larger than in the species to which he has referred it. We cannot use his original name, *serratum*, for the name of the species, because it has already been used in the genus as one of the synonyms of *Aphanorhegma serrata* by C. Müller.

Both of our own manuscript names, which we have rejected, have priority over his varietal one, and he had authentic specimens of both from us at the time that he might have compared with his.

Physcomitrium turbinatum (Michx.) Brid.

Plate (198.)

The following description is drawn from American specimens only:

Plants light green, gregarious, 8–20 mm. high; autoicious-antheridia terminal on lateral or basal branches; stems short and simple or taller and branching, 3–10 mm. high; leaves 3–5 mm. long, oblanceolate or obovate from an oblong base, serrate above the middle; vein ending below the apex or occasionally excurrent into an acuminate apex; lower cells oblong, upper rhomboidal or hexagonal, the marginal longer and narrower, often yellow and inflated at their upper ends; seta 5–15 mm. long, erect or twisted and occasionally arcuate; capsule erect, 1–2 mm. long globose-pyriform when fresh, becoming turbinate, and contracted below the mouth and spore-sac when dry, dark brown and often urceolate when empty; lid convex or mamillate, occasionally apiculate when dry, blunt; mouth bordered by 8–12 rows of cells and a narrow row of orange-colored cells, with a hyaline vesicular annulus, which is persistent and incurved after the falling of the lid; calyptra cucullate, oblique and split unequally, 5–8 lobed and beaked; spores rough, .027–035 mm., maturing in spring.

A common but variable species in old fields, grassy open places in gardens, etc., from Florida to Ontario, west to the Rocky

Mountains and California(?). Type locality in South Carolina. Founded on lax specimens.

Var. Langloisii (R. & C.) E. G. Britton.

(Plate 198.)

P. pyriforme var. *Langloisii* R. & C., Bot. Gaz. **14**: 94 (1889).

Plants pale yellow; stems usually short and simple, slender; occasionally tall and branching to 2 cm.; leaves narrow, acuminate, often 5 mm. long; seta filiform, 10–20 mm. long; capsule small, 1 mm. long, almost campanulate, not contracted below the mouth when dry, neck tapering, often contracted below the spore-sac. Spores maturing in January and February, .027–.035, spinose.

In low swampy ground and in gardens, probably only in the Southern States. Type locality, in Louisiana, Langlois, also collected by Joor and Featherman; Texas, Hockey; Florida, Chapman and J. D. Smith.

Physcomitrium megalocarpum, Kindb. Bull. Torr. Bot. Club, 16: 94 (1889).

Plants the largest of the genus often 3–4 cm. high, light yellow or brown when old; stems short, simple only 3-5 mm. high; leaves spreading flat and open when dry, not much twisted or shrivelled, 5–7 mm. long, 1.5–2 mm. broad, lanceolate from a lax oblong base; lower cells large, inflated at angles, marginal longer and narrower in two rows, yellow, entire or serrulate; vein ending in the acute or acuminate apex; vaginule 1–2mm. long; seta 15–25 mm. long, erect or twisted and bent; capsule large, globose-pyriform, nearly as broad as long, 2–3 mm., usually urceolate when dry contracted at neck and below the mouth when dry; lid conic, bluntly apiculate, mouth small, not flaring, bordered by a narrow orange-colored annulus with a second hyaline row and 8–12 rows of denser, but slightly elongated cells; neck short, stomatose; spores rusty brown, spinose, .027–.035mm., ripe from April to June.

Type locality Victoria, Vancouver Island, Macoun, Canadian Mosses No. 147, also collected by Bolander in California; Watson, Nevada; Henderson, Oregon and Piper in Washington.

Differs from *P. turbinatum* in its greater size, larger, more urceolate capsule, with a longer seta, and in the less inflated cells of the margins of the leaves. The cells bordering the mouth are smaller, which gives it a more pyriform urceolate shape when dry.

PHYSCOMITRIUM AUSTRALE n. sp.

(Plate 199.)

Gymnostomum tortipes Hook.: in Drummonds' Southern Mosses No. 25 (1848), non Brid. Bryol. Univ. **1**: 100 (1826).

Autoicous, the antheridia terminal and cotemporaneous with the fruiting axis. Plants gregarious, tall slender, 3–4 cm. high; stems 25mm. tall, branching repeatedly and rooting at the joints; lower leaves short distant, with the vein ending below the apex, upper 3–4mm. long, 8–10 crowded around the base of the seta, all narrow oblong-lanceolate, serrate above the middle, marginal cells narrower and longer, teeth small appressed; vein ending below the acute apex; seta short, 5mm., pale, twisted and curved; capsules often cernuous, subglobose, becoming turbinate, and flaring at mouth when dry and empty, small, 1–1.5 mm. long, often broader than long, neck tapering, contracted stomatose; lid flat and apiculate when dry, conic when moist, bordered with brown; mouth bordered by 5–8 rows of large, clear cells and a darker annulus, with a second row of hyaline cells incurved and almost invisible, cells of the walls irregular with thick walls; spores rough, warty brown, .037–.043mm., maturing in spring.

Type locality Apalachicola, Florida, Drummond's No. 25, 1848. Not since collected, though specimens gathered by Dr. Garber in Southern Florida in 1878, and distributed as No. 268, resemble this species in the tall, leafy stems, but the pedicels are much longer, not curved, and the mouth is bordered by 8–12 rows of cells, and the spores are smaller. They are probably referable to *P. turbinatum* var. *Langloisii*, and show connecting characters.

The var. *Langloisii* seems to bear the same relation to *P. turbinatum* as var. *calvescens* does to *Funaria hygrometrica*, and *P. australis* corresponds to *var. patulum*. In both cases they are Southern in range, and are propably due to extreme heat and moisture in early spring. They both fruit earlier than the species at the North, and are taller, more slender and yellowish green.

PHYSCOMITRIUM HOOKERI Hampe, Icon. Musc. **3**: *t. 30* (1844).

Gymnostomum latifolium Hook. in Drummond's Musci Am. No. 16 (1828), non Brid.

Gymnostomum latifolium Schwaegr. Suppl. iv. *t. 304* (1842).

Physcomitrium latifolium Lindb. Ofv. Akad. **21**: 595 (1864).

Physcomitrium hians Lindb. Manip. Musc. **1**: 51 (1870).

P. hians Sull. Icon. Musc. Suppl. 26, *t. 16* (1874.)

The first synonym given in L. & J. Manual has already been shown to belong to another species.

Drummond's No. 16 was issued in 1828 by Hooker and Wilson, with the following description:

"*Gymnostomum latifolium* n. sp. acaule, foliis paucis rotundatis acutis imbricatis reticulatis, seta breviuscula, capsula turbinata, operculo plano rostellato, calyptra mitriformi, quadrisixfida."

"Low points of the Saskatchewan, near Carleton House."

Sullivant followed Lindberg in calling it *P. hians*, and says in the Icones: "The reason for displacing this species to constitute of it a mere variety of Drummond's species is not evident. As has already been remarked by Wilson, in the London Journal of Botany (vol. 3, 433, 1841), it is very variable in size, some of the plants being as long as those of *P. pyriforme*, with which it is generally found mixed. Indeed, it apparently may be found passing into that species through intermediate forms."

In Sullivant's herbarium is preserved a portion of the type of *P. hians* Lindb., founded on part of Sullivant's specimens of No. 234, S. & L. Musci Bot. Am. Ed. II., and these were compared with Drummond's No. 16. They are all one species, so that we do not understand the meaning of the above remarks, especially as this species has the most highly developed annulus of the genus, and characteristic leaves. Unfortunately Hooker's very descriptive name, *latifolium*, was pre-occupied by Bridel for a Corsican species (Brid. Bryol. Univ. 1. 760, 1826).

Hampe's name occurs incidentally under the description of *P. Thieleanum*, but he gives *G. latifolium* Hook. as a synonym, and cites Schwægr. Suppl. t. 304, so that this name, and not the one Sullivant figured it under in the Icones, will have to stand.

Type locality: "Low points of the Saskatchewan, near Carlton House, Drummond." It has also been collected in Manitoba and Ontario, by Macoun, Canadian mosses No. 146; Montana, R. S. Williams; South Dakota, T. A. Williams; Minnesota, Lapham and Holzinger; Kansas, W. A. Kellerman and Minnie Reed, and Ohio, Sullivant, by whom it was issued, mixed with No. 234, S. & L. Musci bor. Am. as *P. pyriforme*.

PHYSCOMITRIUM ACUMINATUM (Schleich.) Br. & Sch. Bryol. Eu. *t. 300* (1841).

Gymnostomum acuminatum Schleich. Cat. Pl. Helv. **4**: 40 (1821).

The description is drawn entirely from American specimens:

Autoicous, the antherida terminal on basal branches. Plants gregarious, pale green, slender, 10–15 mm. high; stems short, 2–3 mm., leaves almost radical, rosulate, 2–3 mm. long, oblong-lanceolate, acuminate, vein thick, ending below the apex or excurrent into a cuspidate point; marginal cells elongated in two rows, entire or subserrulate at apex, lower cells elongated, often brown at angles; seta pale, slender, twisted, 10–13 mm. long, often bent; capsules small, 1 mm. long, pyriform, becoming turbinate when dry, with a broad flaring mouth, not contracted below it; neck tapering, often abruptly contracted when dry; mouth bordered by 4–7 rows of narrow cells, but slightly elongated or thickened, those of the walls smaller than in *P. turbinatum* and rounded; annulus double, outer row orange colored, inner hyaline, vesicular, falling in fragments with the lid or persistent; lid blunt, conic or apiculate, bordered with orange; calyptra small 2 mm. long, lobed; spores small, .014–.021 mm., spinose, yellow, ripe in May and June.

Type locality in Switzerland. An uncommon species not yet reported east of the Alleghanies, ranging through the Central States both east and west of the Mississippi. Collected by H. J. Webber at Nebraska City, Nebraska, June 1, 1889; Argentine, Miss Reed, April and May, 1891; Cloud Co., W. A. Carlton; also Phillips Co., Kansas, Hatcher and Farm Ridge, La Salle Co., Illinois, J. W. Huett. Also by E. Hall in Illinois, according to the Manual.

Through the kindness of M. H. Philibert we have received a specimen supposed to be this species, collected by Gander near Lienz, in the Tyrol, in July, 1878. This is one of the specimens cited by Limpricht in his Laubmoose, but does not agree exactly with the description given by him, as the cells around the mouth, instead of being in 11–15 rows, seem to be only six. We have also recently received from Dr. H. Solereder a duplicate specimen from the herbarium of the University at Munich, collected by Wienkamp near Wasam, in May, 1865. They also have only 7–8 rows of cells around the mouth, and a narrow yellow annulus; the lid is short and blunt or truncate. The spores measure .024–.027mm., and are rough but not spinose.

This rare species has only been distributed once in European exsiccatæ and never in American ones, so that we have not much material to guide us. Neither have we been able to see the specimens cited in Lesquereux and James' Manual for this species, for they cannot be found in either Sullivant's or James' herbarium.

The description in the Manual does not fit the American specimens altogether, and we suspect from the localities that they may have confused our *P. Drummondii* with this species. The spores are described as "large." Limpricht cites them as .026–.032 mm., or a little smaller than in *P. pyriforme* and *P. turbinatum*. It will be seen that the spores in our specimens are much smaller.

The following remarks are copied from the Bryologia Europæa, and refer to *P. acuminatum* (*t. 300*):

"Cette espéce que nous avons reçue de Schleicher, se distingue du *P. pyriforme* par sa grandeur moindre, par ses feuilles plus longuement acuminées ordinairement a bords entiers ou a peine denticulés, par la nervure mediane de la feuille qui est excurrente ou qui ne cesse qu'avec le sommet du limbe foliare, par l' embouchure plus large de la capsule sèche et enfin par les sporules presque de moitié plus grandes."

PHYSCOMITRIUM KELLERMANI n. sp.

(Plate 200.)

Autoicous, the antheridia terminal in basal buds. Plants scattered or gregarious, dark brown when mature, small, seldom more than 3–5 mm. high; stems simple, with basal innovations; leaves few, rosulate, 1–3 mm. long, ovate acuminate; vein excurrent into the subulate apex or ending below it; margins coarsely serrate; cells inflated, basal cells lax, scarcely elongated; seta short, 1–2 mm. long, scarcely exceeding the perichætial leaves, occasionally 3 mm. long and exserted; capsule short pyriform or globose when empty, contracted below the mouth or broadly flaring, bright brown when old, 1–1.5 mm. long, neck short, tapering or swollen into an hypophysis, stomatose, rugose; mouth bordered by 4–7 rows of cells, and a narrow persistent annulus of darker cells with a hyaline incurved row almost invisible; lid small, conic-rostrate; calyptra large, 2–2.5 mm. long, 3-lobed; spores large, .045–.048 mm., rough, warty, but not spinose, maturing in March and April.

Type locality, Manhattan, Kansas, Kellerman (1889); also collected by J. B. Hatcher at Long Island, Phillips Co., Kansas (1885) (ex herb. E. A. Rau), by Miss Reed at Argentine, Kansas; and by H. J. Webber at Nebraska City, Nebraska (1889).

Differs from *P. Hookeri*, for which it is liable to be mistaken, by its smaller size, flaring mouth and single annulus; from *P. turbinatum* also in the smaller size and narrow-bordered mouth; from both in its larger spores.

PHYSCOMITRIUM DRUMMONDII, n. sp.

(Plate 201.)

Physcomitrium acuminatum L. and J. Man. 198 (1884) in part?

P. Hookeri var. *serratum* Ren. & Cardot, Rev. Bryol. **19**: 93 (1892).

Plants gregarious or scattered, 3–10 mm. high; stems with short basal branches; leaves narrow, strictly erect, lanceolate-acuminate, 2–3 mm. long, serrate above the middle, marginal cells longer and broader, inflated or yellow, basal cells lax; vein thick, ending below the apex or excurrent into a cuspidate point; seta stout, straw-colored or brown when old, short, only 3–5 mm. long, erect slightly twisted; capsules 1 mm. long, pyriform turbinate, not contracted below the flaring mouth when dry, bordered by 6–8 rows of narrow elongated, thick brown cells, very distinct from the cells, with sinuous walls of the rest of the capsule; annulus narrow, orange-colored, persistent, with a second incurved hyaline row; lid conic-rostrate, bordered by orange, beak as long as the spore-sac, which is shallow and broad; neck contracted below the spore-sac, stomatose; calyptra large, 2–3 mm. long; spores large, .040–.045 mm., warty, maturing April.

Type specimens collected by Drummond near New Orleans, and distributed as No. 24 of his Southern mosses in 1848 as *P. pyriforme*, var. 3. Also collected by A. B. Langlois, at Pointe a la Hache "on ground along roadsides 1886," and distributed as No. 44 of Ren & Cardot's, Musci Am. Sept. Exsic. Recently collected by B. F. Bush, at Campbell, Missouri, and ranging northward into Canada, Belleville, Macoun, west to Oregon, Henderson. The specimens sent to me from the Department of Agriculture, collected by Jermy in Texas, and referred to *P. acuminatum*, with some doubt, are also this species, differing from *P. acuminatum* in its smaller size, strict, erect habit, stout seta, narrow bordered mouth, rostrate lid and larger spores, which are warty not spinose, and double the size of any American specimens of *P. acuminatum*, which I have seen. We suspect Wright's Texan specimens cited in the Manual also belong here, though we have not seen them, but the spores are described as "large." Hall's Illinois specimens are probably *P. acuminatum*.

PHYSCOMITRIUM COLORADENSE n. sp.

(Plate 202.)

Autoicous, the antheridia in basal buds, few, large, without paraphyses. Plants small, 3–4 mm. high, scattered or gregarious; stems short, simple or with basal buds; leaves few, radical, erect, concave, 1.5–2 mm. long, base short, auriculate, cells lax, upper cells shorter, marginal serrate or inflated above the middle, with large irregular teeth, occasionally entire or serrulate only at apex; vein narrow, percurrent into a cuspidate apex, or ending below it in the lower leaves. Seta short, immersed, or partly exserted, 1–2.5 mm. long; capsule exserted, large for the size of the plants, nearly 2 mm. long, pyriform when fresh, becoming turbinate and contracted below the mouth and spore-sac when dry, bright orange or brown when mature; mouth bordered by 4–5 rows of narrow elongated cells, and a double annulus, the outer orange-colored, the inner vesicular, hyaline; lid large conic, rostrate when dry, also bordered with orange cells; spores warty, not spinose, .027–.037 mm., maturing in April and May.

Type locality, Colorado, T. S. Brandegee, April 13, 1877, Eu. herb, E. A. Rau; also collected at Great Falls, Montana, on muddy banks of the Missouri River, by R. S. Williams, May 11, 1887, ex. herb. D. C. Eaton.

Resembling *Pyramidula tetragona* in the large size of the capsule as compared with the small size of the plants, but distinguished by the lobate calyptra and double annulus.

PHYSCOMITRIUM CALIFORNICUM n. sp

(Plate 203.)

Autoicous, the antheridial terminal, becoming lateral by innovations. Plants gregarious, 10-15 mm. high; stems simple, erect, short, 3 mm. high; leaves few, basal, oblong-lancealate, 3 mm. long, bordered by a double row of elongated cells, entire or occasionally serrulate above the middle; vein thick, ending below the acute apex; cells lax, oblong, marginal obliquely septate. Seta 1–2 cm. long, slender, twisted, often brown; capsules small, 1–1.5 mm., globose when mature and empty, more or less cylindric when young; lid conic, short blunt; neck short, wrinkled and contracted below the spore-sac when dry, stomatose; mouth bordered by a narrow orange-colored annulus, and 5–11 rows of slightly denser, scarcely differentiated cells; calyptra cucullate, lobed and long beaked; spores brown, .027–.035 mm. warty, not spinose, maturing in Spring.

On the ground in California (Bolander), without date or locality. Specimens received from the Department of Agriculture in 1889, in a set of Bolander's duplicates, and also to be found in the Lesquereux herbarium, as we learn from M. Cardot.

Differing from *P. acuminatum* in the shape of the capsule and length of the seta, having the slender aspect of *Entosthodon ericetorum*, but with a lobed calyptra, entire leaves, and no trace of a peristome. We have thought it best not to use the original manuscript name which I gave it (*sphærothecum*), as there is a European species *P. sphæricum*, which is named in reference to the globose capsules and a Mexican species, *P. subsphæricum*, Sch.

The following key is given to facilitate the determination of the species of this genus. Only six, of the eleven here enumerated, are known to occur within our limits, *P. turbinatum*, *P. acuminatum*, *P. Drummondii*, *P. immersum*, *P. Kellermani* and *P. Hookeri*. Two are Rocky Mountain species, *P. pygmæum and P. Coloradense;* two are Pacific Coast species, *P. megalocarpum* and *P. Californicum;* and *P. australe*, although here maintained as a species, more specimens may perhaps show that it is only an extreme form of *P. turbinatum*, into which it grades through the variety *Langloisii*. Collectors in our Southern States will do well to observe this species carefully and try to get its extreme forms. *P. Drummondii* may be said to be intermediate between *P. turbinatum* and *P. lanceolatum*, and probably ranges northward through the Mississippi Valley. Spore characters have never been carefully recorded heretofore, and these seem to furnish valuable assistance in determining the species which resemble each other.

KEY TO THE NORTH AMERICAN SPECIES.

Plants 5–10 mm. high, capsules immersed, bordered by two rows of cells.
1. *immersum.*

Plants 3–5 mm. high, capsules exserted, bordered by 4–7 rows of cells.
  Annulus narrow, persistent, leaves serrate,
    Plants 2–3 mm. high, seta short, almost immersed, stems leafy.
    2. *pygmæum.*
    Plants 3–5 mm. high, acaulescent, seta exserted, 1–3 mm. long.
    3. *Kellermani.*
  Annulus double, persistent or falling, leaves entire,
    Plants 3–4 mm. high, seta short, immersed, capsule pyriform.
    4. *Coloradense.*

Plants 5–10 mm. high, seta 2–3 mm., exserted, capsule turbinate.
5. *Hookeri.*
Plants 5–13 mm. high, seta 5–13 mm., mouth bordered by 6–8 rows.
Leaves acuminate, entire, lid blunt, spores .014–.021 mm., spinose.
6. *acuminatum.*
Leaves acute, serrate, lid rostrate, spores .040–.045 mm., warty.
7. *Drummondii.*
Plants 20–30 mm. high, mouth bordered by 4–8 rows of cells,
Stems tall, leafy, branching, seta curved, spores .037–.042 mm., warty.
8. *australe.*
Plants 5–25 mm. high, mouth bordered by 8–12 rows of cells, spores .027–.035 mm.
Margins serrate, cells inflated, spores spinose, annulus of two rows of cells.
Capsules turbinate, 1–2 mm., mouth flaring, 9. *turbinatum.*
Capsules pyriform, 2–3 mm., urceolate, mouth not flaring,
10. *megalocarpum.*
Margins entire, cells elongated, spores warty, capsules globose.
11. *Californicum.*

The Genus Cassia in North America.[*]

BY CHARLES LOUIS POLLARD.

Since the publication of Bentham's monograph in 1871[†], the genus *Cassia* has received no detailed treatment. The discovery of new material in the South and Southwest during recent years renders a revision of the North American species desirable. The present paper enumerates only those forms which are known to occur north of the Mexican boundary, the numerous tropical species being reserved for later consideration. The classification into subgenera, sections and series is that of Bentham, with such modifications as seemed necessary to adapt it to North American forms exclusively.

Analytical Key to the North American Species.

Leaves with a spinulose rhachis, 27. *C. armata.*
Leaves with rhachis not spinulose.
Leaves 2–9–foliolate.
Peduncles 1–flowered.
Leaves 2–foliolate, 2. *C. pumilio.*

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[*] Submitted to the University Faculty of Pure Science of Columbia College as partial requirement for the degree of Master of Arts.

[†] Trans. Linn. Soc. London, **27** : 503–591.

- Leaves 4–8–foliolate.
  - Leaves coriaceous, 18. *C. Greggii.*
  - Leaves not coriaceous.
    - Plant cinereous-pubescent, 17. *C. grammica.*
    - Plant glabrous, 16. *C. Wrightii.*
- Peduncles 2–many–flowered.
  - Leaves 2–foliolate.
    - Peduncles 2–flowered, 3. *C. bauhinioides.*
    - Peduncles several–flowered, 1. *C. Roemeriana.*
  - Leaves 3–9–foliolate.
    - Legume turgid, not exceeding 5 cm. in length.
      - Plant puberulent, 4. *C. crotalarioides.*
      - Plant silky-pubescent or tomentose.
        - Leaves 2–3–foliolate, 5. *C. Covesii.*
        - Leaves 4–6–foliolate, 6. *C. Lindheimeriana.*
    - Legume exceeding 5 cm.
      - Petiolar gland wanting, 14. *C. Wislizeni.*
      - Petiolar gland at base of rhachis.
        - Stipules filiform.
          - Leaves 4–6–foliolate, 8. *C. occidentalis.*
          - Leaves 6–9–foliolate, 10. *C Marylandica.*
        - Stipules linear, foliaceous.
          - Legume 20–25cm. long, 7. *C. leptocarpa.*
          - Legume 8 cm. long, 9. *C. ligustrina.*
      - Petiolar gland between lowermost pair of leaflets.
        - Leaflets obovate, 11. *C. Tora.*
        - Leaflets elliptical.
          - Peduncles 2–flowered, 13. *C. biflora.*
          - Peduncles several-flowered, 12. *C. Bahamensis.*
- Leaves 6–24–foliolate.
  - Plants glabrous or subglabrous.
    - Petiolar gland large, truncate, 19. *C. Chamæcrista.*
    - Petiolar gland minute, cupuliform.
      - Flowers pedunculate, peduncles 1 cm. long. 21. *C. Mississippiensis.*
      - Flowers nearly or quite sessile.
        - Stipules linear, scarious, 15. *C. calycioides.*
        - Stipules lanceolate, striated. 22. *C. nictitans.*
  - Plants hispid or pubescent.
    - Flowers more than 2–5 cm. broad.
      - Leaflets small, cinereous, 25. *C. cinerea.*
      - Leaflets large, glabrate, 20. *C. Chamæcrista robusta.*
    - Flowers less than 2–5 cm. broad.
      - Legumes geminate, hispid, 23. *C. aspera.*
      - Legumes not geminate.

Leaflets tipped with a rigid acuminate point,
26. *C. Simpsoni.*
Leaflets acutely subfalcate, 24. *C. procumbens.*

SUBGENUS I. FISTULA.

Unrepresented in the United States.

SUBGENUS II. SENNA.

Herbs or shrubs, rarely trees. Petiolar gland when present more or less prominent, subglobose, oblong or slender, and stipitate. Flowers in racemes, which often become paniculate or corymbose, usually terminating the younger branches. Stamens 10, the three upper and occasionally a lower one reduced to staminodia; anthers oblong, truncate or more often rostrate at apex, dehiscent by 1 or 2 terminal pores or chinks; base obtuse, more or less bilobed. Legume of variable shape, dehiscent along one or both sutures, more rarely indehiscent; valves inelastic. Ovules funiculate, longitudinal or transverse.

Section A. CHAMÆFISTULA.

Our species all herbs. Leaves inter-glandulose or eglandulose. Perfect stamens 7, staminodia 3. Legume terete, turgid or compressed, usually dehiscent along dorsal suture, more rarely along both sutures. Ovules transverse, separated by septa.

Series *Bacillares*, *Corymbosæ* and *Excelsæ* unrepresented in the the United States.

Series *Brachycarpæ*.

Leaves 2-many-foliolate. Anthers equal, or the 2–3 inferior longer, subrostrate. Legume short, curved or sometimes straight, turgid, submembranaceous, bivalvate. Racemes few-flowered, or when many-flowered becoming corymbose-paniculate.

1. Herbs with perennial rhizome; leaves 2-foliolate.

1. CASSIA RŒMERIANA Scheele.

Cassia Rœmeriana Scheele, Linnæa, **21**: 457 (1848).

Plant of medium height, clothed with closely appressed pubescence, sending up several–many stems from the thick, knotty rhizome; leaflets densely pilose, lance-linear, 3–6 cm. long, .75–1.2 cm. wide, asymmetrical at base, borne on a somewhat elongated rhachis; stipules filiform, persistent; petiolar gland slender, conical, situated between lowermost pair of leaflets; peduncles 2–4 flowered, forming terminal corymbose racemes; sepals ovate, membranaceous; petals strongly veined; legume nearly straight, turgid, mucronate, dehiscent along both sutures; dorsal suture prominent; length 2.5–3 cm., width .5 cm.; seeds numerous.

Texas and New Mexico, extending south into Mexico.

2. CASSIA PUMILIO A. Gray.

Cassia pumilio A. Gray, Bost. Journ. Nat. Hist. **6**: 180 (1850).

Plant low (8–15 cm.), with tufted stems from the long, branching rhizome; stems and leaves sparsely pubescent; leaflets linear, or the earliest obovate (3–3.5 cm. long, 2 cm. wide), slightly shorter than the elongated rhachis; petiolar gland slender, setaceous, situated between lowermost pair of leaflets; stipules acute, linear, membranaceous, persistent; flowers resembling those of *C. Rœmeriana*, but solitary on elongated axillary peducles; calyx persistent; sepals slighty shorter than petals; legume turgid, oval, truncate, finely pubescent; length 1.5 cm., width 7 cm.

West Texas and New Mexico, extending south into Mexico.

3. CASSIA BAUHINIOIDES A. Gray.

Cassia bauhinioides A. Gray, Bost. Journ. Nat. Hist. **6**: 180 (1850).

Plant of medium height, somewhat branching, densely pubescent, pilose or even tomentose; leaflets oblong-ovate, very asymmetrical at base, canescent beneath, 2–3 cm. long, 1–1.5 cm. wide; petiolar gland setaceous, situated on rhachis just below lowermost pair of leaflets; stipules filiform, persistent; peduncles two-flowered, forming corymbs at the ends of the branches; sepals thin, membranaceous, elliptical; legume villous, compressed, straight or subfalcate, acute, dehiscent along both sutures; length 3–5 cm., width 5 cm.; seeds numerous.

The leaflets are apt to vary in shape and size; in seedling specimens they are nearly orbicular, but later pass into the narrow form.

West Texas, New Mexico and Arizona, extending south into Mexico.

4. CASSIA CROTALARIOIDES Kunth.

Cassia crotalarioides Kunth, Mimos. 132, *t. 40.* (1819–24.)

Fruticose at base, branching freely; stems and leaves pubescent; leaves 2–3 foliolate, the leaflets all borne near termination of rhachis; leaflets ovate-elliptical, slightly asymmetrical at base, densely pubescent, acute or obtuse, 2–2.25 cm. long, .7–1 cm. wide; petiolar gland setaceous, situated between lowermost pair of leaflets; stipules long, filiform; inflorescence a corymbose raceme, many-flowered; petals large, conspicuous; sepals smaller, lanceolate; legume turgid, slightly compressed, oblong-oval, (1.75 cm. long, .75 cm. wide,) sparsely pubescent; dorsal suture straight, mucronate-tipped; ventral suture more or less curved; seeds few.

Arizona.—Grand Cañon, Colorado Plateau, Moseley (1884). Kew Herb.; Mexico.

No specimen collected within the boundary limits of the United States exists in the Columbia College Herbarium; but the locality given above, in which it was found by Prof. Moseley when collecting for the Kew Herbarium, leads us to suppose that it occurs in other portions of Arizona and New Mexico.

5. Cassia Covesii A. Gray.

Cassia Covesii A Gray, Proc. Am. Acad. 7: 399 (1868.)

Stems branching from the base; plant thickly clothed with finely appressed, silky pubescence; leaves 2–3 foliolate; leaflets asymmetrical at base, ovate or oblong-elliptical, mucronate, 2.5–3 cm. long, 1.2 cm. wide; petiolar gland setaceous, situated between lowermost pair of leaflets; occasionally an accessory gland of similar appearance is present between second pair; stipules filiform, persistent; racemes numerous, axillary, many-flowered; flowers large; sepals small, ovate-elliptical; legume subterete, acute, many seeded, straight or subfalcate, 3.5 cm. long, 6 cm. wide.

This species is not included in Bentham's monograph. The two specimens in the Columbia Herbarium differ in the degree of pubescence.

Nevada and Southern California extending through Arizona south into Mexico.

6. Cassia Lindheimeriana Scheele.

Cassia Lindheimeriana Scheele, Linnæa, 21: 457 (1848).

Plant of medium height, branching, silky-pubescent; leaves 4–6-foliolate; leaflets asymmetrical, oval or elliptical, acute or mucronate, white-tomentose beneath, 2.7–3 cm. long, 1.5 cm. wide; petiolar gland setaceous, situated between the next to the lowermost pair of leaflets; stipules linear, membranaceous; racemes loosely many-flowered, becoming corymbose at terminations of branches; sepals ovate-lanceolate, striated; legume straight, acute, apparently indehiscent, subglabrous, very much compressed, 5 cm. long, .5 cm. wide; seeds numerous.

Texas, New Mexico and Arizona, extending south into Mexico.

Section B. ONCOLOBIUM.

Shrubs or herbs. Perfect stamens 7, staminodia 3. Legume turgid or compressed, often arcuate, dehiscent along both sutures, variable in length.

1. Leaves 4–8 foliolate, sharply acuminate; legume linear, elongated.

7. CASSIA LEPTOCARPA Benth.

Cassia leptocarpa Benth. Linnæa, **22**: 528 (1849).

Fruticose or suffruticose, tall, branching, pubescent, leaves 5–7 foliolate; leaflets acuminate, lanceolate, basally symmetrical, densely pubescent, 5–6 cm. long, 1.5–1.8 cm. wide; petiolar gland large, sessile, obconical; stipules lanceolate, foliaceous, caducous; inflorescence in short axillary racemes; calyx corolla-like, the oval sepals not surpassing the petals; legume narrowly linear, subglabrous, with prominent sutures, 20–25 cm. long, .3 cm. wide; seeds very numerous, quadrilaterally compressed.

New Mexico and Arizona, extending south into Mexico.

8. CASSIA OCCIDENTALIS L.

Cassia occidentalis L. Sp. Pl. 539 (1733).

Tall, annual, herbaceous, glabrous; leaves 4–6 foliolate; leaflets lanceolate, becoming lance-elliptical, subglaucous beneath, 3.6–5 cm. long, 1–2 cm. wide; petiolar glands 2, sessile, conical, situated between lowermost pair of leaflets; stipules filiform, caducous; flowers large, in closely-crowded axillary racemes; sepals rather short, oval or lance-ovate; legume linear, turgid, slightly compressed, glabrous, straight, or arcuate, the sypta externally prominent, 11 cm. long, 6 cm. wide; seeds numerous, parallel with the transverse septa.

Virginia and Southern Indiana, southward into Mexico. (Adventive or naturalized from Tropical America.)

9. CASSIA LIGUSTRINA L.

Cassia ligustrina L. Sp. Pl. 541 (1753.)

Herbaceous, glabrous; stem with prominent longitudinal ridges; leaves 6–8-foliolate; leaflets lanceolate, glabrous, 4–4.2 cm. long, 1 cm. wide; petiolar gland at base of rhachis, elongated, stipitate; stipules linear, membranaceous, caducous; racemes few-flowered, forming a corymbose panicle; sepals oval, membranaceous, shorter than the petals; legume flat, glabrous, with slightly sinuate sutural margins, 8 cm. long, .6 cm. wide; seeds parallel with the valves.

Florida, extending south into the West Indies and widely distributed in Tropical America.

10. CASSIA MARYLANDICA L.

Cassia Marylandica L. Sp. Pl. 541 (1753).

Tall, branching, herbaceous, glabrous; leaves 6–9-foliolate; leaflets acute-elliptical, submucronate, glaucous beneath, slightly asymmetrical at base, 4–5 cm. long, 1.4 cm. wide; petiolar gland obconical, stipitate, situated a short distance above base of rhachis; stipules filiform, ciliate, caducous; racemes short, many-flowered; sepals oval, more or less petal-like; legume falcate, flat, linear, somewhat hispid, with septal constrictions forming undulate sutural margins, 10–12 cm. long, .6 cm. wide.

Southern Connecticut, extending south to Florida and west to Nebraska, Kansas and Louisiana.

Section C. PROSOSPERMA.

Shrubs or herbs. Perfect stamens 6 or 7; staminodia 3. Legume linear, tetragonal, straight or curved, dehiscent along both sutures.

Series *Toræ.*

Peduncles short, 1–2 flowered; leaves 2–3 foliolate.

11. CASSIA TORA L.

Cassia Tora L. Sp. Pl. 538 (1753).

Tall, glabrous, herbaceous; leaves 2–3-foliolate, glabrous or pubescent beneath; leaflets obovate-elliptical or wedge-obovate, very slightly cuspidate, the terminal pair much the largest, all symmetrical or nearly so at base, 3–5 cm. long, 2.5 cm. wide; petiolar glands slender, elongated, situated between lowermost pair of leaflets; stipules long, linear, persistent; racemes loose, few-flowered; flowers large; sepals oval, membranaceous; legume long, linear, acute, falcate, more or less tetragonal, glabrous, 16–18 cm. long, .3 cm. wide; seeds numerous, large, quadrilaterally compressed.

Southern Virginia, extending south to Florida and Cuba, west to Southern Indiana and Arkansas. Also in Tropical America.

Series *Confertæ*, *Laxifloræ* and *Coriaceæ* unrepresented in the United States.

Section D. CHAMÆSENNA.

Shrubs or rarely herbs. Perfect stamens 7 (rarely 6), staminodia 3. Legume compressed, dehiscent by both sutures. Seeds transverse or oblique.

A. *Leaves interglandulose, or glands sometimes wanting.*

Series *Pachycarpæ.*

Leaves few–many-foliolate; stipules setaceous or caducous; legume usually with convex valves.

12. CASSIA BAHAMENSIS Mill.

Cassia Bahamensis Mill. Gard. Dict. Ed. 8, No. 9 (1768).

Fruticose, tall, glabrous, or somewhat pilose; leaves 3–5-foliolate, subcoriaceous; leaflets ovate or acutely elliptical, submucronate, 3.5–5 cm. long, 1.6 cm. wide; petiolar gland orbicular, depressed, varying in position from between lowermost pair of leaflets to near base of rhachis; stipules linear, caducous; inflorescence corymbose-paniculate; sepals petal-like; legume linear, flat, with lateral depressions between the seeds, 9 cm. long, .5 cm. wide.

Florida, extending into the Bahamas.

Series *Aphyllæ* unrepresented in the United States.

Series *Rostratæ.*

Anthers of 2–3 lower stamens terminated by a cylindrical, pore-bearing beak. Legume generally narrow, with planular valves. Leaflets few to many, obtuse, or rarely becoming acute. Stipules linear, setaceous or caducous. Peduncles 1–2-flowered, rarely 3–4-flowered.

13. CASSIA BIFLORA L.

Cassia biflora L. Sp. Pl. 540 (1753).

Fruticose, branching; stem glabrous or pilose; leaves 4–10-foliolate, usually pubescent or canescent beneath, sometimes glabrous; leaflets oblong-elliptical, acute or obtuse at apex, 4 cm. long, 1.6 cm. wide; petiolar gland stipitate, slender, acute, situated between lowermost pair of leaflets; stipules linear, membranaceous, caducous; peduncles 2-flowered, in close terminal racemes; flowers large; sepals oblong-elliptical, equal in length with petals; legume falcate, narrowly linear, 9 cm. long, .5 cm. wide.

Florida, extending into the West Indies; also in Mexico.

Series *Auriculatæ* unrepresented in the United States.

B. *Leaves eglandulose.*

Series *Floridæ.*

Racemes axillary or corymbose-paniculate. Legume with flat valves, usually elongated.

14. Cassia Wislizeni A. Gray.

Cassia Wislizeni A. Gray, Pl. Wright, 1: 60 (1852).

Fruticose, branching; leaves small, glabrous, 4–7 foliolate; leaflets wedge-obovate or oblong-oval, slightly acuminate, 5 mm. long, 3 mm. wide; petiolar gland minute or wanting; stipules aculeate; inflorescence in crowded paniculate racemes, becoming corymbose at terminations of branches; flowers large and conspicuous; legume flat, elongated, with prominent sutures, 9 cm. long, .7 cm. wide; seeds numerous, transverse, causing external swellings on valves.

West Texas and New Mexico, extending south into Mexico.

Series *Pictæ* and *Brachycarpæ* unrepresented in the United States.

Section Psilorhegma unrepresented in the United States.

SUBGENUS III. LASIORHEGMA.

Shrubs or herbs, rarely trees. Petiolar glands when present depressed, scutelliform, sessile or stipitate. Stamens 10, all perfect, rarely several wanting or reduced to staminodia; filaments short, anthers oblong-linear, dehiscent by short slits at the apex, more rarely laterally. Legume usually flat, the valves elastic, ventrally and dorsally dehiscent. Seeds transverse or oblique.

Sections Apoucouita and Absus unrepresented in the United States.

Section Chamæcrista.

Flowers usually solitary on axillary peduncles. Anthers often unequal.

Subsection *Xerocalyx.*

Sepals subscarious, many-striate. Leaves 1-many-foliolate.

15. CASSIA CALYCIOIDES D.C.

Cassia calycioides D.C. Prod. 2: 503 (1825).

Low, spreading, herbaceous, more or less pilose; leaves 6–15-foliolate, glabrous or subpilose; leaflets linear, finely acuminate, .7 cm. long, .15 cm. wide; petiolar gland slender, cupuliform, stipitate; stipules linear, scarious, persistent; flowers small, solitary on very short axillary peduncles; legume linear, acuminate, pubescent, 4–4.5 cm. long, 5 cm. wide.

Texas, New Mexico and Arizona, extending south into Mexico.

Subsection *Leiocalyx.*

Sepals membranaceous, scarcely striate.

Series *Subaphyllæ* and *Prostratæ* unrepresented in the United States.

Series *Paucijugæ.*

Shrubs or perennial herbs, erect or spreading; leaves 3–7-foliolate, subcoriaceous; petiolar gland small, slightly stipitate.

16. CASSIA WRIGHTII A. Gray.

Cassia Wrightii A. Gray, Pl. Wright, 2: 50. (1853).

Low, branching, herbaceous or suffruticose at base; leaves glabrous, membranaceous, 4–8-foliolate; leaflets elliptical, obtuse or submucronate, .7 cm. long, .2 cm. wide; rhachis short; petiolar gland very small, cupuliform, substipitate; stipules lanceolate; peduncles 1-flowered; flowers large; legume glabrous, linear, acute, 4 cm. long, .5 cm. wide; seeds numerous, oblique.

New Mexico and Arizona, extending south into Mexico.

17. CASSIA GRAMMICA Spreng.

Cassia grammica Spreng. Neue Entd. 3: 55 (1822).

Low, branching, herbaceous or suffruticose at base, densely pubescent; leaves 4–6-foliolate; leaflets elliptical or sub-obovate, mucronate, subcoriaceous, canescent beneath, 1 cm. long, .3 cm. wide; petiolar gland obsolescent, sessile, compressed; stipules aculeate; peduncles 1-flowered; flower large; legume pubescent, linear, mucronate; length (in young specimen) 3 cm., width .4 cm.; seeds few, oblique.

Florida, extending south into Cuba.

Series *Coriaceæ* unrepresented in the United States.

Series *Subcoriaceæ.*

Shrubs or perennial herbs, erect; leaves 3–10-foliolate, obtuse, subcoriaceous; petiolar gland sessile; stipules small.

18. CASSIA GREGGII A. Gray.

Cassia Greggii A. Gray, Pl. Wright, 1 : 59 (1852).

Fruticose, glabrous; leaves 3–5-foliolate; leaflets oblong-oval, slightly truncate, 1 cm. long, 4 cm. wide; nerves prominent; petiolar gland compressed, minute; stipules filiform, often caducous; peduncles 1-flowered; legume not observed.

This species occurs in South Texas, according to Bentham's statement (Monograph, p. 575); but all the specimens which I have examined were collected in Mexico.

Series *Chamæcristæ veræ*.

Herbaceous or suffruticose; leaves 8–20-foliolate, membranaceous; petiolar gland sessile or stipitate; stipules small; legume flat.

19. CASSIA CHAMÆCRISTA L.

Cassia Chamæcrista L. Sp. Pl. 542 (1753).

Tall, herbaceous, glabrous; leaves 8–12-foliolate; leaflets oblong-elliptical, acute or mucronate, 1.5 cm. long, 3 cm. wide; petiolar gland sessile, comprsssed, cupuliform; stipules lance-linear, membranaceous; peduncles numerous, supra-axillary, 3–5-flowered; flowers large; sepals membranaceous, lanceolate, equalling or exceeding the petals; legume elongated-linear, subrostrate, pubescent, 5 cm. long, .5 cm. wide; seeds numerous, transverse.

Maine, extending south to Florida and west to Minnesota, Kansas and Mexico.

20. CASSIA CHAMÆCRISTA ROBUSTA, n. var.

Tall, branching, herbaceous; stems densely pubescent, stout; leaves glabrate, 10–15-foliolate; leaflets elliptical, basally asymmetrical, obtuse, finely cuspidate, 2 cm. long, .5–.6 cm. wide, occasionally an odd one terminating the rhachis; petiolar gland circular, truncate, compressed, sessile; stipules foliaceous, broadly lanceolate, striated; peduncles 1–3-flowered, supra-axillary, flowers large and conspicuous, red or orange-red; sepals small, membranaceous, lanceolate, only half as long as the petals; stamens 10, 5 larger, 5 smaller, perfect; legume narrow, linear, pubescent, 4 cm. long, .5 cm. wide.

Type a single specimen in the Columbia College Herbarium collected by Dr. C. W. Short in the mountains of Kentucky, and referred by him with doubt to *C. aspera*, with which, however, it has almost nothing in common.

21. CASSIA MISSISSIPPIENSIS n. sp.

Low, branching, suffruticose,; stem terete, glabrous; leaves subcoriaceous, pubescent, 8–14-foliolate; leaflets small, elliptical or obovate, mucronate, basally asymmetrical, 5 cm. long, .1–.15 cm. wide; secondary nerves 3 or 4, opposite, rarely alternate; petiolar gland minute, cupuliform, sessile, situated midway between lowermost pair of leaflets and base of rhachis; stipules acutely linear, membranaceous, persistent; peduncles 1 cm. long, axillary, 1-flowered; flower large (petals 1 cm. long, .3 cm. wide); anthers 10, rostrate, all perfect, the lower 5 larger, yellow, the upper smaller and reddish; anther-sacs dehiscent by terminal pores; sepals lance-linear, slightly pubescent, not surpassing the petals; legume turgid, linear, sparsely pubescent, ventrally and dorsally dehiscent, elastic; length 2.5 cm., width .4 cm.; seeds 4 or 5, ovoid, rather large (longest diam. 3 mm.) transverse.

Type in herbarium of Columbia College, collected by Miss K. Skeehan, 1889, at Ocean Springs, Mississippi.

The specific characters are well-marked, the only *Cassia* to which it bears any resemblance being *C. pygmæa* D.C., a Cuban species, and not reported, so far as I know, from any of the States. *C. pygmæa* may be distinguished by its dense hirsute pubescence, its oblique seeds and fewer pinnæ on the rhachis. The two plants in general external appearance are quite similar.

22. CASSIA NICTITANS L.

Cassia nictitans L. Sp. Pl. 543 (1753.)

Low, herbaceous, branching and spreading freely; leaves glabrous, 6–14-foliolate; leaflets linear-elliptical, acute or mucronate, 1–1.4 cm. long, .2–.3 cm. wide; petiolar gland urceolate, subsessile; stipules small, foliaceous, lanceolate, striated; peduncles 1-flowered, supra axillary; flowers small, inconspicuous, subsessile; legume pubescent, submembranaceous, acute, 3.5 cm. long, .6 cm. wide; seeds few, oblique.

Southern New England, extending south to Florida, and west to Indiana, Kansas and Louisiana.

23. CASSIA ASPERA Muhl.

Cassia aspera Muhl; Ell. Bot. S. Car. & Georg. 1: 474 (1821).

Tall, erect, herbaceous; stem hispid with fulvous hairs; leaves 20–24-foliolate, glabrous; leaflets narrowly linear, acuminate, 1 cm. long, .15 cm. wide; petiolar gland slender, erect, elongated; stipules linear, membranaceous, striated; peduncles 2–3-flowered, supra-axillary, very short; flowers rather larger than in *nictitans*; legumes usually in pairs, hispid, somewhat obtusely linear, 2.8 cm. long, .6 cm. wide; seeds few, oblique.

Florida—Jacksonville, Curtiss; Key West, Blodgett.

It seems to be the result of carelessness on Bentham's part that he has inserted *C. aspera* Muhl. as a synomyn of *C. nictitans* L. Even if the differences were not sufficiently well marked to warrant the establishment of a species, there could be no doubt whatever that they constituted a varietal distinction. But *aspera* has hispid stems, while *nictitans* is glabrous; the petiolar gland in the one case is slender and elongated, in the other urceolate, subsessile; *aspera* produces pods in pairs, while *nictitans* does not.

C. aspera bears a much closer resemblance to the Cuban *C. patellaria* D.C. than it does to *nictitans;* and the differences are harder to detect. In *patellaria*, however, the venation is radically different, the costa adjoining the superior margin of the leaflets, while in *aspera* it occupies very nearly a medial position. *C. patellaria* is downy-pubescent, not hispid, the flowers are smaller and sessile.

24. CASSIA PROCUMBENS L.

Cassia procumbens L. Sp. Pl. 543 (1753).

Prostrate, branching from a fruticose base; leaves 18–24-foliolate, pubescent; leaflets very small, linear, acutely subfalcate, .5 cm. long, .1 cm. wide, on a stout rhachis; petiolar gland minute, situated midway between the lowermost pair of leaflets and base of rhachis; stipules cordate, foliaceous; peduncles rather long, 1-flowered, axillary; flower large; legume linear, puberulent, somewhat crisped, with prominent sutural margins, length 3.5 cm., width .4 cm.

Texas—Nealley (1889), extending south into Mexico.

Series *Dimidiatæ*.

Suffruticose or herbaceous, procumbent, rarely erect; leaves 8–30-foliolate, narrow, acute; costa approximating superior margin or coalescing with it.

25. CASSIA CINEREA Cham. & Schlecht.

Cassia cinerea Cham. & Schlecht. Linnæa **5**: 599 (1830).

Suffruticose, branching, puberulent; leaves 10–20-foliolate, clothed with cinerous pubescence; leaflets narrow, linear-falcate, acute, 1 cm. long, .2 cm. wide; petiolar gland small, cupuliform, stipitate; stipules filiform or linear; peduncles 1–2-flowered, rather short, axillary or supra-axillary; flowers large; legume linear, pilose or sparsely pubescent, rostrate, somewhat elongated, 5–5.5 cm. long, .5 cm. wide, seeds oblique.

Texas (Drummond)—extending south into Mexico.

26. Cassia Simpsoni n. sp.

Low, branching from a fruticose base; stem more or less puberulent; leaves 8–12-foliolate; leaflets glabrous or subglabrous, small, narrowly linear (5 mm. long, 1 mm. wide), tipped with a black, rigid, acuminate point; costa approaching the superior margin; secondaries 4 to 5, oblique, almost parallel with the costa; petiolar gland minute, stipitate, obconical, situated on rhachis just below lowermost pair of leaflets; stipules foliaceous, tipped with rigid acuminate points similar to those on leaflets; flowers sessile or subsessile, somewhat supra-axillary, .5–.8 cm. broad; sepals lanceolate, membranaceous, equalling the petals; legume flat, linear, hirsute, subrostrate, 2 cm. long, .4–.5 cm. wide; seeds few, oblique.

Florida—Big Pine Key, Simpson (May, 1891), No. 174.

Type, three specimens in the National Herbarium, collected by Mr. J. H. Simpson, to whom the species is dedicated. One of these specimens is an entire plant, measuring 21 cm. in height, of very compact, shrubby form. The most prominent specific characteristic is the rigid acuminate point terminating the apices of the leaflets and stipules, a feature not observed in any other *Cassia*.

27. Cassia armata S. Wats.

Cassia armata S. Wats. Proc. Am. Acad. 11: 136 (1876).

Herbaceous, puberulent; leaves with an elongated, flattened, spinulose rhachis 4–6 cm. long, often impari-pinnate, 2–7-foliolate; leaflets distributed at irregular intervals on rhachis, alternate or opposite, ovate or sometimes crescentic in outline, subcoriaceous, .5 cm. long, .3 cm. wide; petiolar gland and stipules wholly wanting; flowers rather large, numerous in elongated axillary racemes; pedicels slender, subtended by rigid aculeate bracts; perfect stamens 7, staminodia 3; mature legume not observed.

Nevada—Wheeler (1872).

California—Palmer (1876); San Diego, Orcutt (1889).

Arizona—Mohave Desert, Mr. and Mrs. Lemmon (1884).

In none of the specimens in the Columbia College Herbarium, or those in the Department of Agriculture, are mature pods represented. The young pod, according to Watson's description, is "stipitate glabrate, linear, acuminate, compressed, the sutures thick and nerve-like," a set of characters that might be applied to almost any *Cassia*. The two detached pods on a sheet in the Department of Agriculture Herbarium, collected by Wheeler in Nevada, apparently do not belong to the genus at all, but as Mr. Coville has remarked, seem to be those of *Acacia Greggii*.

Until this odd species can be more carefully examined, it has been thought best not to include it in the regular sequence. While belonging to the subgenus *Senna*, it is not referable to any of Bentham's sections.

Steps toward a Revision of the linosporous Species of North American graminicolous Hypocreaceæ.

By Geo. F. Atkinson.

Certain of the linosporous species of Hypocreaceæ present such a similarity in the character of the asci and spores that some uncertainty seems to exist regarding the generic relationship. This has led to the incorporation of some species under the same genus without regard to certain well-defined and important differential characters of the stroma. In the study of several species collected in Alabama my attention has been called to these peculiarities, and this step toward a revision of the species is offered here as a contribution upon the subject.

The genus *Epichloë* Fr. is here restricted to those characters of the stroma of which *E. typhina* is the type.

The genus *Hypocrella* was erected by Saccardo to include species with quite a variety of stroma but which in contradistinction from *Epichloë* was disciform, and did not surround the host, or substratum, as *E. typhina* does. The new genus *Dothichloë* is here proposed for those species of *Hypocrella* which possess a dothidiaceous stroma and are represented by forms like *Epichloë Hypoxylon* Pk.

Hypocrea tuberiformis B. & Rav. with linear spores is made the type of another genus, for which the name *Echinodothis* is proposed.

The characters of these two new genera may be given as follows:

DOTHICHLÖE Atkinson.

Stroma dothidiaceous, black, hard, especially the outer portions, lighter within, but the dark color is present to a considerable depth, of like structure throughout though varying in color, pulvinate, effused, disciform or armillæ-form, partly or entirely surrounding the host or substratum, continuous or interrupted. Perithecia, or ascigerous cells, crowded, confluent with the stroma, immersed, the apex projecting above and giving it a granulose, rugose, or convolute appearance. Asci cylindrical, 8-spored. Spores filiform, septate, eventually separating at the septa into short segments.

DOTHICHLOË HYPOXYLON (Pk.).

Epichloë Hypoxylon Pk. 27th Rep. N. Y. State Mus., 108.

Hypocrella Hypoxylon Sacc. Syll. **11**: 581.

Stroma 5–20 mm. long, usually occupying one side of the leaf and may be either epiphyllous or hypophyllous, sometimes entirely surrounding the host. Perithecia 100–150 μ in diameter and nearly twice as long, the conical apices projecting slightly above the stroma give it a granulose appearance. Asci 150–200 × 4–5 μ. linear, tapering to a slender point at the base and crowned by a hyaline truncate apex. Spores nearly the same length as the asci, but 1 μ in diameter, curved and interwoven in the ascus.

This species is very common in the United States upon grasses. *Hypocrea atramentosa* B. & C. Journ. Linn. Soc. **10**: 377, is probably also a synonym of this species. What I have taken to be this plant I found very abundant on the under side of the leaves of *Andropogon Virginicus* in Alabama. It agrees well with authentic specimens of Peck's species. Ellis also includes in the synonymy of this species *Dothidea vorax*, *atramentaria* and *pilulæformis* B. & C. *D. atramentaria* B. & C. in Ellis' N. A. F., No. 683, from South Carolina is certainly the same. The others I have not seen.

Saccardo places *Dothidea vorax*, *pilulæformis* and *atramentaria* B. & C. in the genus *Ophiodothis* of the Dothideaceæ as *D. vorax* (B. & C.), Sacc. var. *pilulæformis* and var. *atramentaria*, the latter variety referring to No. 100, Rav. F. Amer. The specimen which I have seen of this number of Rav. F. Amer. is mostly immature, but sufficiently developed to identify it as the same species as *D. atramentaria* B. & C. in Ellis N. A. F. No. 683, and also identical with the *Dothichloë Hypoxylon* (Pk.), as above described. Saccardo's genus *Ophiodothis* is characterized as possessing continuous spores. This together with the different character of the stroma of such species as *O. Haydeni* (B. & C.) distinguishes it from *Dothichloë*.

Dothichlœ Aristideæ n. sp. Stroma dimorphic, sterile portion confluent, forming a thin black layer, in the specimens seen entirely surrounding the culm. Fertile portion much thicker, confluent or interrupted, forming small perpendicular elevations on the sterile portion, projecting apices of the crowded perithecia more or less confluent in an irregular manner giving a rugulose or convolute appearance to the stroma. Otherwise as in *D. Hypoxylon*. On *Aristida purpurascens*, Auburn, Ala. Collected by B. M. Duggar.

The simple agreement in character of the asci and spores of these species cannot be taken as of specific identity where there are other characters sufficiently distinct, for there is no appreciable difference between the asci and spores of *Epichloë typhina* and those of *Dothichoë Hypoxylon*, and in several species of *Cordyceps* they are very similar.

Epichloë strangulans (Mont.) Sacc., which according to Saccardo is dothideaceous in color, may belong to this genus, but I have not seen the plant.

There may be some question as to the proper location of the genus *Dothichloë*, whether it should remain in the Hypocreaceæ or be transferred to the Dothideaceæ.

ECHINODOTHIS Atkinson.

Stroma subcarnose, of corky consistence, pulvinate, light colored, tuberculate and constricted at base, or disciform, or irregular, partly or sometimes entirely surrounding the host, or substratum, composed of several layers, or strata, of different consistence. Perithecia subcylindrical, sessile, giving an echinate appearance to the stroma. Asci cylindrical, 8-spored. Spores linear, septate, at length separating at the septa into short segments.

Echinodothis tuberiformis (B. & Rav.).

Hypocrea tuberiformis B. & Rav. Grev. **4**: 13.

Hypocrella tuberiformis Atkinson, Bot. Gaz. **16**: 282 (1891).

Stroma subglobose, simple or lobed, irregular, usually seated upon one side of the culm but occasionally entirely surrounding it, fastened to the substratum by whitish radiating threads. When young conidiophorous, covered with needle-shaped basidia 35–40 × 2–3 μ, bearing oval or broadly fusoid conidia, 3.5–4 × 7–10 μ. When mature composed of three strata of different color, the inner whitish tinged with pink, intermediate layer light ochre, and outer layer cinnamon. The intermediate layer is less compact than the other two. Perithecia 1 mm. long by one-third millimeter in diameter, singly or in groups of 3–4 or 20, or crowded, sometimes branching below. Asci large, 450–750 × 14 μ, tapering to a slender point at base, more gradually toward the somewhat enlarged, conoid, truncate apex. Spores pluriguttulate as well as pluriseptate, nearly as long as the ascus. On stems of *Arundinaria macrosperma* var. *suffruticosa*, Ala. and S. C.

Among the other material collected in Alabama is a graminicolous fungus, which at the time of collection I took to be, from its external appearance, the same as *Dothichloë Hypoxylon.* Upon examination it proves to be very different, and is the type of a new genus for which the name *Myriogenospora* is here proposed. Although the spores are not strictly linosporous and the species belongs plainly to the Dothideaceæ, it seems well to characterize it here.

MYRIOGENOSPORA Atkinson.

Stroma pulvinate, effused, carbonaceous. Perithecia immersed, confluent with the stroma, crowded, apex not very prominent. Asci subcylindrical, many-spored. Spores slender, continuous, hyaline.

MYRIOGENOSPORA PASPALI n. sp.

Stroma one to two centimeters long, seated upon one side of the young culm in the cases observed, and partly enclosed on the sides by the equitant leaf blade. Perithecia large, 200–300 μ in diameter, oval or obovate, projecting above the stroma but little by a small conical apex producing a slight unevenness of the surface. Asci large, 200–250 × 15–20 μ, tapering each way to slender ends, more strongly so at the base, so that they appear oblanceolate in side view. Spores very numerous, several hundred, narrowly apiculate, 15–25 × .5–.8 μ, fusoid, straight or slightly curved. On *Paspalum læve.* Auburn, Ala., collected by B. M. Duggar.

BOTANICAL DEPARTMENT, CORNELL UNIVERSITY.

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VonS

Teratological Notes.

By Hermann Schrenk.

(Plate 204.)

In growing a number of seedlings for physiological experiments, some curious forms of the common bean (*Phaseolus vulgaris*) were found.

The first was a case of division of the embryo into two unequal halves, which, although they were united, seemed to grow independently. The hypocotyle had been divided, and to each half one cotyledon was attached, while the plumule remained entire and was joined to one-half of the hypocotyle (Figs. 1 and 2). In germinating both halves of the hypocotyle broke through the seed-coats, but one of them (r), grew very much faster than the other. The result was that the smaller half with its cotyledon and the plumule was pushed above the soil (s. p. h.). When the plant was about one inch in height, the smaller hypocotyle produced two thick prong-like roots, but several days passed and still the plumule showed no signs of activity. The other half meanwhile was growing vigorously, the cotyledon markedly diminished in size, and a bud appeared at the union of the hypocotyle with the cotyledon (*b.* Fig. 2). This increased in size and began to unfold; a small leaf appeared similar in shape to the primordial leaves. Another bud was formed, but it was weak and never developed.

The smaller half had grown very little, the hypocotyle thickened somewhat, but otherwise no change took place. From this it would seem that there had been no passage of nutritive material or water from the part of the plant connected with the soil to the other half, in other words, the two parts appeared like separate individuals. After eight days the smaller half showed signs of wilting. With a sharp razor the cotyledon (*s*), the plumule (*p*) and hypocotyle (*h*) were cut from the other half of the hypocotyle (*r*) and were planted in rich soil. The next day the plumule began to unfold, the two primordial leaves spread out, but they remained small and developed no further. The whole died shortly after. The roots produced by the hypocotyle had no doubt been weakened by the week's exposure to the air (although kept in a very moist atmosphere), and were no longer capable of absorbing.

Some twenty or thirty seeds were found that had three cotyledons. The majority of these developed three primordial leaves instead of two (Figs. 3 and 4). Two of the three cotyledons were of approximately the same size, and were situated on the first node, about sixty degrees apart. The third cotyledon was somewhat smaller than the other two and was placed a little above the node, midway between the others. The plumule had the three primordial leaves fully formed in each case examined; they were in a whorl and alternated with the cotyledons. The bud situated between them elongated, but, instead of a single three-parted leaf being formed at the third node, two opposite leaves appeared. In some of the seedlings two buds were situated between the whorl at the second node, each of which formed an internode, at the end of which was a three-parted leaf. From this point each stem grew regularly, giving rise to a twining stem bearing alternate leaves. Six of the plants were allowed to flower and ripen their seed; the latter were planted, but not one of the forty-four seeds grew into seedlings with more than two cotyledons.

An interesting case of polyembryony was met with in two seeds of the Indian corn (*Zea Mays*) (Figs. 5 and 6). Two hypocotyles ruptured the seed coats about the same time, and the following day two plumules made their appearance. One of the seeds was allowed to grow. Both plumules formed healthy leaves, the hypocotyles developed strong roots, and to all appearances both plants were as vigorous as if they had been grown from separate seeds.

Description of Plate 204.

FIGS. 1 and 2.—"s," cotyledon of smaller half; "l" cotyledon of larger half; "p," plumule; "h," smaller hypocotyle; "r," larger hypocotyle; "b," bud (×2).

FIG. 3.—Bean with three cotyledons; seven days old.

FIG. 4.—Bean with three cotyledons; two days older.

FIG. 5.—Front view of corn. "b," larger plumule; "s," smaller plumule just breaking through the coats. "t," smaller hypocotyle; "c," larger hypocotyle.

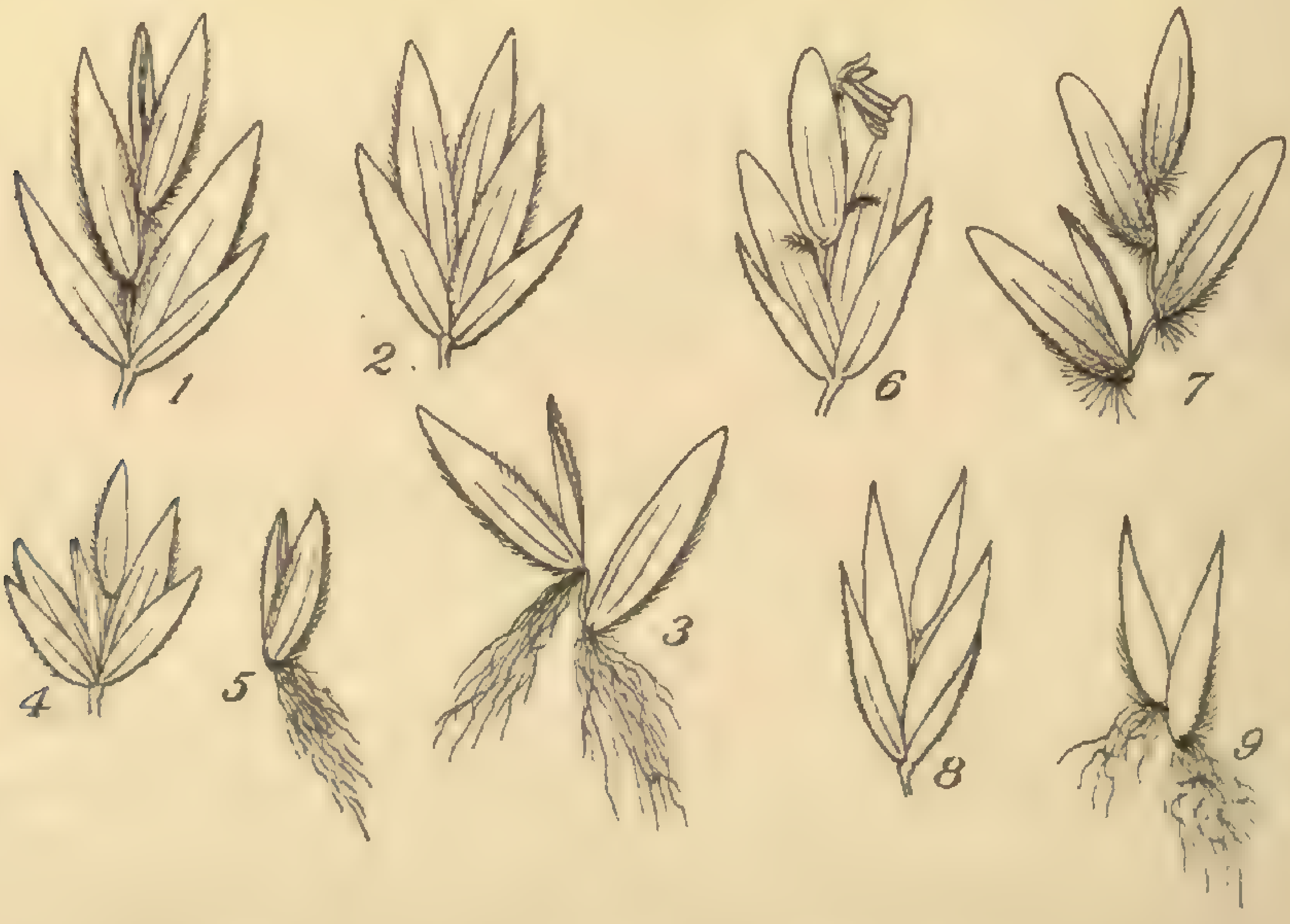
FIG. 6.—Side view of corn. (Same lettering as Fig. 5.) (×2)

BOTANICAL LABORATORY, Cornell University.

Three new or noteworthy Grasses.

BY F. LAMSON-SCRIBNER.

Some ten or twelve years ago Mr. J. Wolf collected in Illinois a *Poa* which was thought to be only a form of *Poa alsodes* by Dr. A. Gray and a variety of *P. flexuosa* Muhl. by Dr. Vasey. Specimens thus ticketed by Dr. Vasey are in my herbarium and in the herbarium the University of Tennessee, and similar specimens collected by Wolf which are ticketed in Dr. Vasey's hand writing, "*Poa alsodes* var. *Wolfii*." In working up the *Poas* for "The Grasses of Tennessee" I find that Dr. Gattinger collected the grass in question several times within the State. The first specimens are marked "Lavergne, May, 1882," the last "Cedar glades. Lavergne, 1890." Finding these specimens among our Tennessee plants led to a close examination of the characters of the grass with the result that it appears to the writer to be quite distinct and readily separable from either *P. flexuosa* Muhl. or *P. alsodes* Gray.



FIGS. 1–5. Spikelets of *Poa Wolfii* Scribn.
FIGS. 6, 7. Spikelets of *Poa flexuosa* Muhl.
FIGS. 8, 9. Spikelets of *Poa alsodes* A. Gray.

The species is thus characterized: A slender perennial, 1–3 feet high with a loose nodding panicle. Leaves 1–2 lines wide, 3–6 inches long; sheaths rather loose, mostly shorter than the internodes, the lower scarious; ligule ½ lines long; panicle slender, lax, 3–6 inches long, primary branches 2–3 rarely more at each node of the main rhachis; spikelets ovate, 2–3 lines long, 3–5-flowered; rachilla often flexous; empty glumes sub-equal, 3-nerved; flowering glumes strongly carinate, lanceolate, 5-nerved, silky-villous along the margins and keel and with a copious, long web at the base.—Ill., Tenn., Kansas.

Festuca Shortii Kunth; Wood, Class Book, 794 (1863).

Allied to *F. nutans* Willd. Spikelets 3–4-flowered, ovate, broader above, 2–3 lines long, usually much exceeding the pedicels in length. Empty glumes lanceolate, acute, slightly unequal, the first 1-nerved, 1¾ lines long, the second 3-nerved, 2 lines long, nerves scabrous; flowering glume ovate-oblong, obtuse, obscurely 5-nerved, smooth or minutely roughened on the keel near the apex, more or less rounded on the back. Palea broad, strongly 2-keeled, about equalling the glume. Grain obovate, pubescent at apex, lodicules smooth. Panicle shorter than in *F. nutans*, 4–8 inches long, the broader spikelets more crowded at the extremities of the ascending branches. In the mature specimens the spikelets are turgid and the florets have the appearance of being oblong and very obtuse.

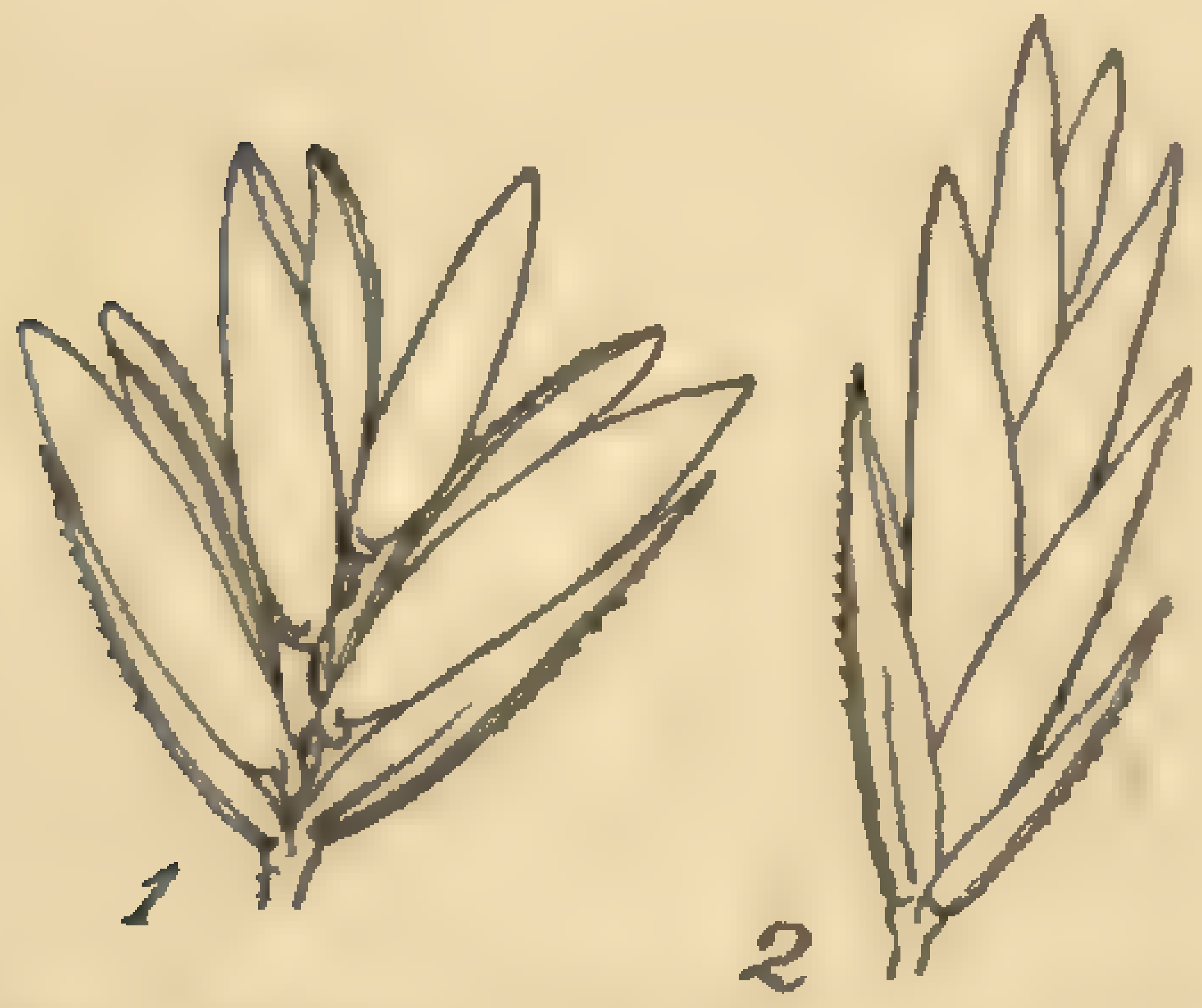


Fig. 1. Spikelet of *Festuca Shortii.*
Fig. 2. Spikelet of *Festuca nutans.*

Kunth is cited by Dr. Wood as the author of *F. Shortii*, but I do not find this name in any of Kunth's writings. Probably it is an herbarium name. An examination of Wood's herbarium or the herbarium of Dr. Short, which is at the Philadelphia Academy of Natural Sciences, may serve to settle this point. In later writings Wood reduced the species to a variety of *F. nutans*. In his "Flora Atlantica" (1879), he calls it *F. nutans* var. *palustris* (p. 399). It is, I think, a good species, readily distinguished from *F. nutans* by its less elongated panicle, more crowded and much broader spikelets.

Uniola longifolia Scribn. n. sp.

Lower culm-leaves a foot long or more, 3–5 lines wide; sheaths elongated, concealing the nodes, somewhat compressed and more or less villous with a dense ring of soft short hairs at the summit. Inflorescence as in *U. laxa* (*U. gracilis*), but with the main axis and branches stouter and more rigid, and the spikelets somewhat larger.

Little Stone Mountain, DeKalb county, Georgia, July (John K. Small); Florida (Curtiss N. Am. Pl., No. 3521); Mississippi (S. M. Tracy); Hiawassee Valley, Tenn. (A. Ruth); Tullahoma, Middle Tenn. (A. Gattinger).

Death of Dr. Thomas Morong.

Dr. Thomas Morong, Curator of the Herbarium of Columbia College, and a Vice President of the Club, died at his son's home in Boston, Mass., April 26th, 1894, after an illness of some four months. An account of his life and botanical works will appear in the June number of the BULLETIN.

Botanical Notes.

A New Systematic Botany of North America is announced under the editorship of George F. Atkinson, Cornell University, Ithaca, N. Y.; Nathaniel L.Britton, Columbia College, New York City; John M. Coulter, Lake Forest University, Lake Forest, Ill.; Frederick V. Coville, U. S. Department of Agriculture, Washington, D. C.; Edward L. Greene, University of California, Berkeley, Cal.; Byron D. Halsted, Rutgers College, New Brunswick, N. J.; Arthur Hollick, Columbia College, New York City, and Lucien M. Underwood, De Pauw University, Greencastle, Ind. The editors are already assured of the coöperation of over forty American botanists.

The general sequence of orders will be based on that adopted by Professors Engler and Prantl in their "Natürliche Pflanzenfamilien," now approaching completion, and the work will be divided into seventeen volumes, and issued in parts averaging about 100 pages each. About five of these parts will constitute each volume. Printed schemes giving the proposed sequence of orders and contents of volumes may be had on application to the Chairman of the Board of Editors.

No illustration is contemplated, but copious references to published plates and figures will be made a feature. In addition to the technical characterizations, chapters dealing with the economic, palæontologic and horticultural aspects of each order will be appended. Especial attention will be given to the verification of original descriptions, to the examination of type specimens, to the citation of type localities and to geographical distribution.

No attempt will be made, to treat the groups consecutively, but the sequence of orders being tentatively established in advance, and the number of genera and species being approximately known, it is possible to print parts of all the volumes, or of as many of them as is desired, at about the same time. It is hoped that five or six parts can be issued annually, beginning in 1895. Several parts are already in preparation.

Each monographer will be responsible for his own matter, the only restrictions placed on contributors being that they conform to a general style, to principles of nomenclature and to citations, and that descriptions be extended only to an average limit of a certain number of words, this number to be hereafter determined. The treatment of these matters will be indicated by sample sheets which will be distributed at an early date. It is expected that an approximately uniform consideration of species can be secured.

The editors believe that by prosecuting the work in the manner above indicated, it will be possible to produce a complete Systematic Botany of the country within fifteen years. They fully realize the impracticability of such a task being accomplished by a few students only, and earnestly desire the aid and support of all American botanists. Inquiries and communications may be addressed to any of the editors.

N. L. BRITTON,
Chairman.

CRATÆGUS PUNCTATA CANESCENS n. var.—Under this name I characterize a thorn collected by Dr. Thos. C. Porter at Easton, Pa., and by the late Dr. Robbins at Ferrisburg, Vt. The specimens differ markedly from the type in having the lower surfaces of the leaves, as well as the petioles, peduncles and pedicels, densely white-tomentose. N. L. BRITTON.

Reviews.

Fossil Cycadean Trunks of North America, with a Revision of the Genus Cycadeoidea Buckland. Lester F. Ward (Proc. Biol. Soc. Wash. **9**: 75–87. April 9, 1894).

The author has here gathered together such information as was available regarding fossil cycad trunks found in America. They have been found in the trias of North Carolina and Prince Edward Island and in the lower cretaceous of Maryland and the West. An interesting discovery, showing the value of fossil plants in the correlation of strata, is briefly alluded to. In the Geology of the Black Hills, by Newton & Jenney, no strata below the middle cretaceous (Dakota Group) are recognized. The presence of cycad trunks, however, led the author to infer that strata representing an older geological horizon, must be represented there. An expedition to the locality was accordingly made in company with Prof. Jenney, during the past year, with the result that a conclusion was reached that while the upper part of the strata in question undoubtedly represent the Dakota Group, the lower part probably extend down to the base of the cretaceous—an age equivalent to that of the Maryland strata. Details in regard to the evidence upon which the conclusion was based are promised in a subsequent paper.

The author has also included a revision of the genus *Cycadeoidea* Buckland, in which the nomenclature is revised in accordance with the law of priority. Forty-two species are enumerated, only seven of which are American. One of these is from the Black Hills locality, and is described as a new species under the name *Cycadeoidea Jenneyana.*

Cycadeoidea Carruthersi is proposed to replace *Mantellia intermedia* Carruthers (1870), the trivial name *intermedia* being preoccupied by *Cycadeoidea intermedia* Ranzani (1836). Attention is also called to the fact that Brongniart wrote the genus name

Cycadoidea, merely on the ground of euphony, which of course can not be sanctioned under recently adopted rules of nomenclature, hence Buckland's original name; *Cycadeoidea*, is used by the author, and under it he includes the genera *Mantellia*, *Cycadites*, *Zamites*, *Eucephlartos*, *Clathropodium*, *Strobilites*, *Echinostoipes*, *Bennettites*, *Bolbopodium*, *Raumeria*, *Clathraria*, *Tysonia*, *Cycas*, *Zamiostrobus*, etc., either entire or in part. In the author's words, "This genus seems to be the ultimate destiny of all cycadean trunks of dwarf bulb-like or conical form, deciduous leaf stalks and rhombic leaf scars." A. H.

Annotated List of the Fossil Plants of the Bozeman, Montana, Coal Field, with Table of Distribution and Description of Species. F. H. Knowlton. (Bull. U. S. Geol. Surv. No. 105, pp. 43–63, Pl. V., VI.)

This list contains forty-five species, of which the following are described as new: *Thinnfeldia lanceolata*, *Populus? problematica*, *Litsea Weediana*, and *Cinnamomum ellipticum*—the latter previously identified by Lesquereux with *C. polymorphum* Al. Br. Specimens doubtfully referred to *Equisetum* and *Nelumbo* are also included and *Quercus Paelei*, Lesq., is reduced to identify with *Q. Ellisiana*, Lesq. From an analysis of the table of distribution the fact is adduced that the flora finds its nearest allies in the Denver beds of Colorado and from the stratigraphic relations of the rocks they appear to represent a horizon between the Laramie and the Fort Union beds. A. H.

Proceedings of the Club.

Tuesday Evening, April 10, 1894.

The President in the chair and 26 persons present.

Dr. Britton spoke of his announcement at the previous meeting of a probable new species of *Rhamnus* and stated that subsequent observations had led him to consider it probable that this was an introduced species, *R. Frangula L.*

The announced papers of the evening were then read:

(1) By Dr. Britton, "The Morphology and Classification of the Cyperaceæ," illustrated by lantern slides.

(2) By Mr. Theodore G. White, "The Wild Peas of North America." This paper was illustrated by numerous specimens. Mr. White stated that the subject grew in interest the more it was studied, and that he could not even yet present a complete report upon the species, of which, however, he believed there were 30.

WEDNESDAY EVENING, APRIL 25, 1894.

Vice-President Allen in the Chair and 17 persons present.

Reports were received from the Field Committee on meetings held at Lakewood, N. J., and Dunwoodie, N. Y., the latter being cited as a station for *Viola rotundifolia*.

Miss Margaret P. Waterman was elected an active member.

The following papers were read:

"The Genus *Cassia* in North America," by Charles L. Pollard. The paper was illustrated by specimens and diagrams, and is published in the present issue of the BULLETIN.

"Some new and interesting species of *Polygonum*," by John K. Small, illustrated by specimens and drawings. (Published in the April BULLETIN.)

"New species of Characeæ," by Dr. T. F. Allen, illustrated by drawings. (Published in the April BULLETIN.)

Index to Recent Literature relating to American Botany.

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Cultures of *Isaria farinosa.*

Atkinson George F. Germination of the Spores of *Cerebella Paspali.* Bull. Torr. Bot. Club, **21**: 127, 128, *pl. 183*. 24 Ma. 1894.
Relationship of plant still uncertain.

Ayres, H. B. A miniature Water Lily. Science, **23**: 109. 1894.
Note on distribution of *Nymphæa odorata* Ait. var. *minor* Sims, in Minnesota.

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Bessey, Charles E. The Botany of the Apple Tree. Annual Rep. Nebraska Hort. Soc. reprint, pp. 36. 27 Ma. 1894.

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Chickering, J. W. The Botanical Landscape. Science 23: 118. 1894.

Clendenin, Ida. Observations on the Zoospores of *Chætophora endiviæfolia.* Asa Gray Bull. No. 5, 13. 1894.

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Davidson, Anstruther. Californian Field Notes—III. Erythea, 2: 61–64. 1 Ap. 1894.

Notes from Big Rock Creek, Los Angeles County.

Deane, Walter. The Ware Collection of Blaschka glass Models of Flowers. Bot. Gaz. 19: 144–148. 14 Ap. 1894.

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Figures are given of *Coprinus comatus, Cantherellus cibarius, Boletus subtomentosus, Clavaria aurea, Scleroderma vulgare* and *Morchella esculenta.*

Ganong, W. F. On the Absorption of Water by the green Parts of Plants. Bot. Gaz. 19: 136–143. 14 Ap. 1894.

Preliminary experiments render such absorption improbable.

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Golden, Katharine E. Botany in the Schools. Science, **23**: 119. 1894.

Greene, Edward L. Historical notes of some Californian Trees.—II. Erythea, **2**: 64–67. 1 Ap. 1894.

Notes on the oaks, particularly *Quercus lobata.*

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Poisonous influence of *Ranunculus acris.*

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A Venezuelan species.

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Porter, Thomas C. Notes on certain Plants of our Eastern Flora. Bull. Torr. Bot. Club, **21**: 120–123. 24 Mr. 1894.

Pringle, C. G. Notes of Mexican Travel—VII.–IX. Gard. & For. **7**: 152, 162, 172, *fig. 30, 32*. Ap. and Mh. 1894.
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Rowlee, W. W. Aeration of Tissues and Organs in *Mikania* and other Phanerogams. Am. Mo. Mic. Journ. **15**: 45–49. 1894.

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Sargent, C. S. *Prunus orthosepala.* Gard. & For. **7**: 184, *fig. 34*. 9 My. 1894.

Sargent, C. S., Editor. The Date Palm. Gard. & For. **7**: 164, *fig. 31*. 25 Ap. 1894.
Illustration and notes of *Phœnix dactylifera*.

Schneider, Albert. Beitrag sur Kenntniss der Rhizobien. Ber. Deutsch. Bot. Gesel. **12**: 11. 1894.

Small, John K. Morphological notes on the genus *Brunnichia*. Bull. Torr. Bot. Club, **21**: 131–132, *2 figs*. 24 Ma. 1894.

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Trelease, William. Notes and Observations. Ann. Rep. Mo. Bot. Gard. **5**: 154–166, *pl. 27–32*. 1894.
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Description of a species from Costa Rica.

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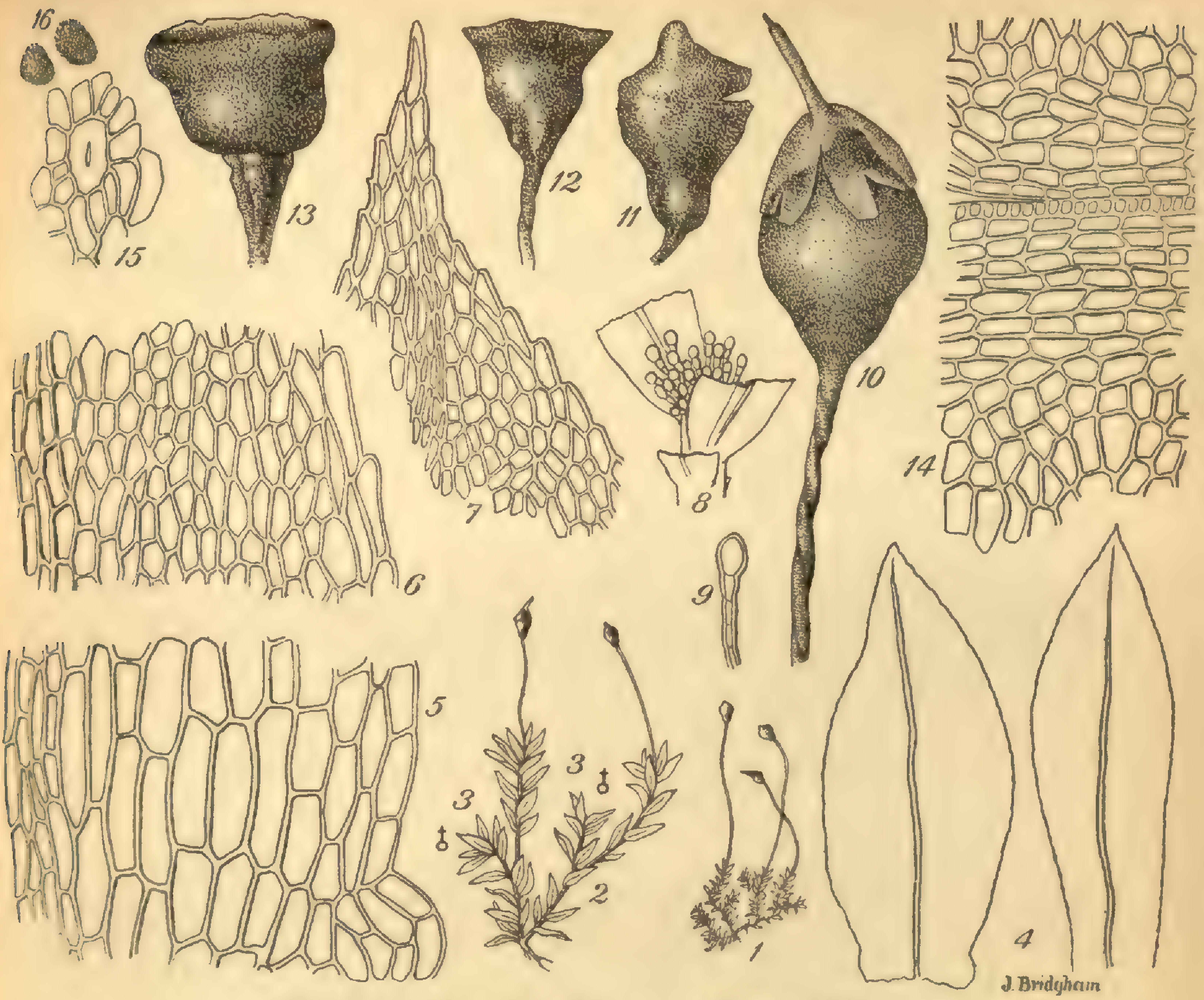
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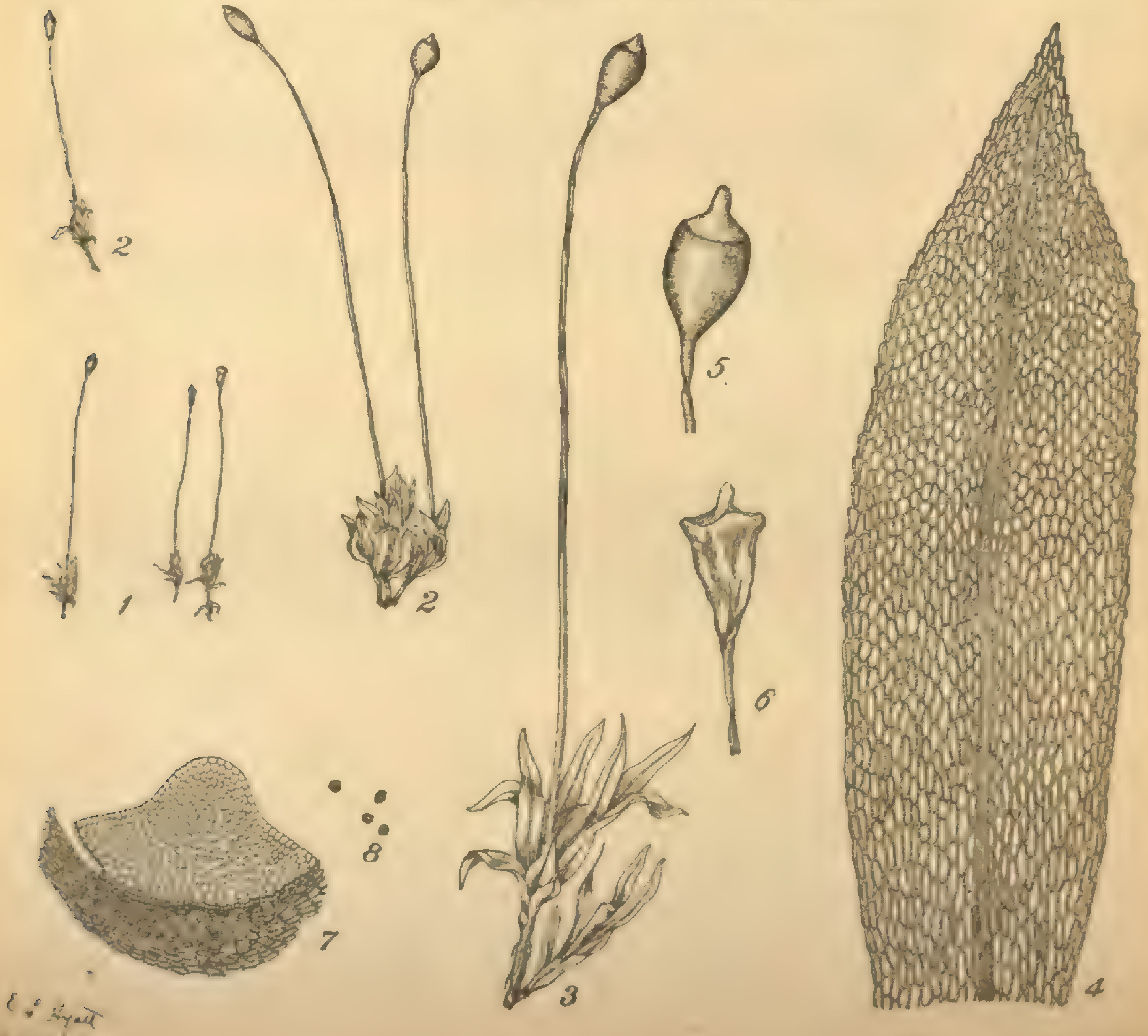
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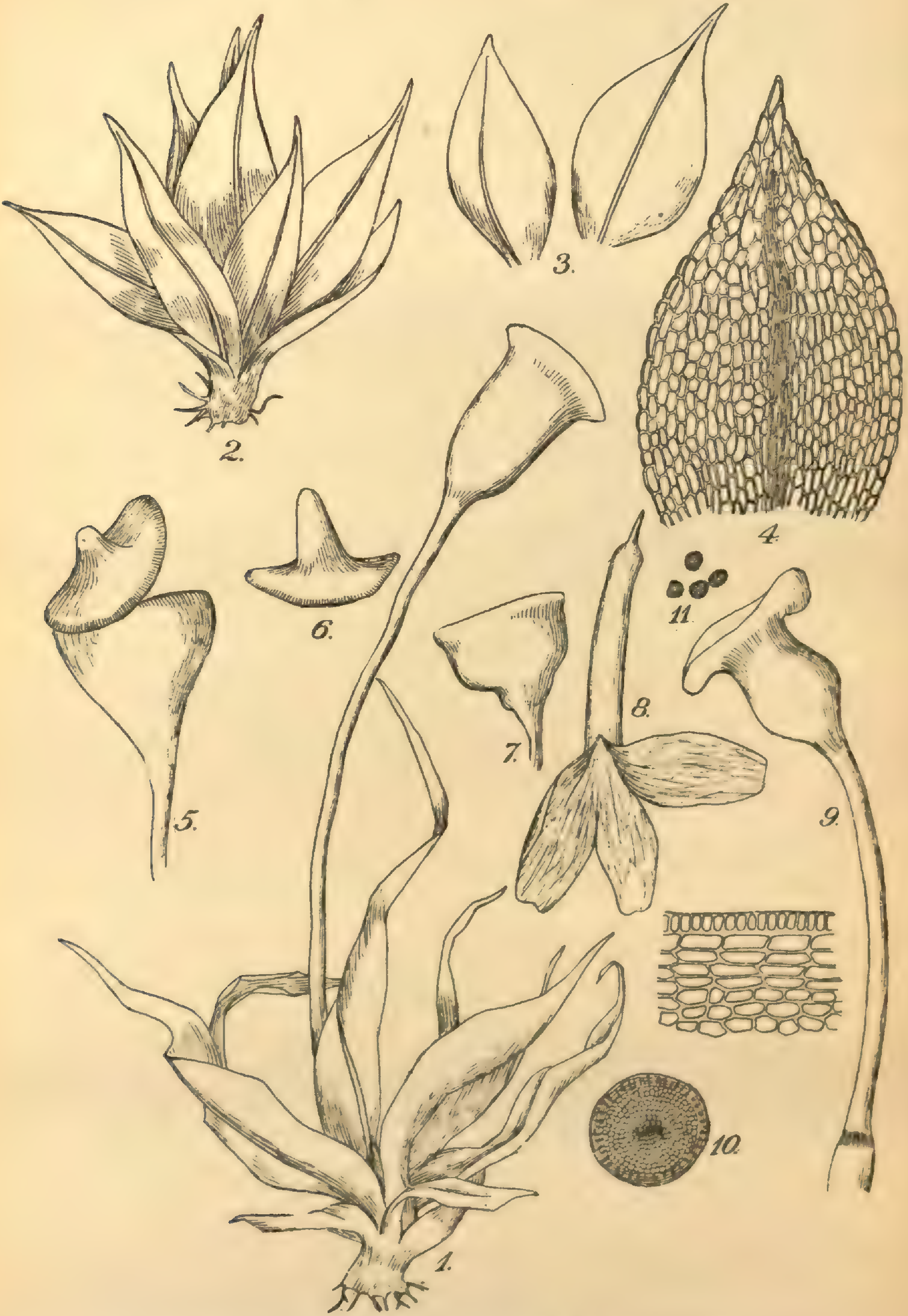
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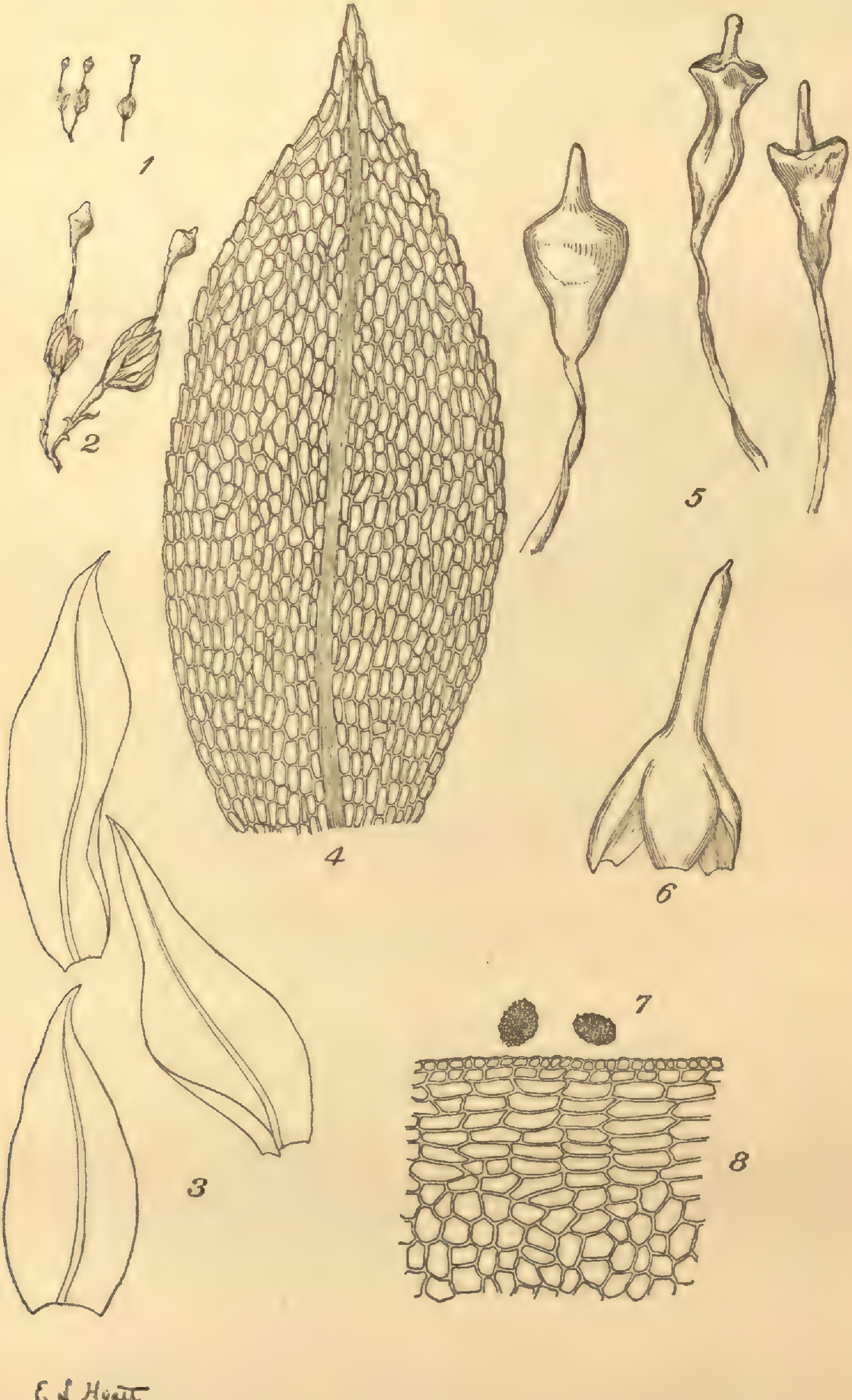
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PHYSCOMITRIUM DRUMMONDII E. G. BRITTON.

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PHYSCOMITRIUM COLORADENSE E. G. BRITTON.

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PHYSCOMITRIUM CALIFORNICUM E. G. BRITTON.

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Fig. 1. Fig. 2. Fig. 3. Fig. 4. Fig. 5. Fig. 6.

TERATOLOGY OF THE EMBRYOS OF PHASEOLUS VULGARIS AND ZEA MAYS.

Contributions from the Herbarium of Columbia College.

[The numbers omitted from this list are out of print.]

No. 4.	A List of Plants Collected by Miss Mary B. Croft at San Diego, Texas. By N. L. Britton and H. H. Rusby (1887),	25 cents.
No. 5.	New or Noteworthy North American Phanerogams. By N. L. Britton (1888),	25 cents.
No. 6.	An Enumeration of the Plants Collected by Dr. H. H. Rusby in South America, 1886–1887. By N. L. Britton. (Twenty-three parts published; not yet completed.)	
No. 7.	The Genus *Hicoria* of Rafinesque. By N. L. Britton (1888),	25 cents.
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	The General Floral Characters of the San Francisco and Mogollon Mountains and the Adjacent Region. By H. H. Rusby (1888),	25 cents.
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No. 12.	The Genus *Eleocharis* in North America. By N. L. Britton (1889),	25 cents.
No. 13.	New or Noteworthy North American Phanerogams, II. By N. L. Britton 1889),	25 cents.
No. 14.	A List of State and Local Floras of the United States and British America By N. L. Britton (1890),	$1
No. 15.	A Descriptive List of Species of the Genus *Heuchera*. By Wm. E. Wheelock (1890),	25 cents.
No. 16.	New or Noteworthy North American Phanerogams, III. By N. L. Britton (1890),	25 cents.
No. 17.	The Flora of the Desert of Atacama. By Thos. Morong (1891),	25 cents.
No. 19.	Notes on North American Haloragæ. By Thos. Morong (1891),	25 cents.
No. 20.	New or Noteworthy North American Phanerogams, IV. By N. L. Britton. (1891),	25 cents.
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No. 23.	The American Species of the Genus *Anemone* and the Genera which have been referred to it. By N. L. Britton (1891),	25 cents.
No. 24.	Review of the North American Species of the Genus *Xyris*. By Heinrich Ries (1892),	25 cents.
No. 25.	A Preliminary List of the Species of the Genus *Meibomia* occurring in the United States and British America. By Anna M. Vail (1892),	25 cents.
No. 26.	A List of Species of the Genera *Scirpus* and *Rynchospora* occurring in North America. By N. L. Britton (1892),	25 cents.
No. 27.	Note on a Collection of Tertiary Fossil Plants from Potosi, Bolivia. By N. L. Britton (1892),	25 cents.
No. 28.	The Anatomy of the Stem of *Wistaria Sinensis*. By Carlton C. Curtiss (1892),	25 cents.

No. 29.	New or Noteworthy North American Phanerogams, VI. By N. L. Britton (1892),	25 cents.
No. 30.	*Ranunculus repens* and its Eastern North American Allies. By N. L. Britton (1892),	25 cents.
No. 31.	A Preliminary List of American Species of *Polygonum*. By John K. Small. (1892),	25 cents.
No. 33.	A New Species of *Listera*, with Notes on Other Orchids. By Thos. Morong (1893),	25 cents.
No. 34.	The North American Species of *Lespedeza*. By N. L. Britton (1893),	25 cents.
No. 35.	An Enumeration of the Plants Collected by Dr. Thos. Morong in Paraguay 1888–1890. By Thomas Morong and N. L. Britton, with the assistance of Miss Anna Murray Vail (1892–1893),	$1.50
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No. 37.	Further Notes on American Species of *Polygonum*. By John K. Small (1893),	25 cents.
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VOL. 21. JUNE, 1894. No. 6.

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TORREY BOTANICAL CLUB.

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EDITED BY

NATHANIEL LORD BRITTON,

AND OTHER MEMBERS OF THE CLUB.

CONTENTS:

PAGE.
Thomas Morong: *N. L. Britton* 239
A Revision of the Genus *Lechea*: *N. L. Britton* 244
Fossil *Salvinias*, including Description of a new Species (PLATE 205): *Arthur Hollick* 253
On a Species of *Helianthemum* not recognized in our Text-books: *Eugene P. Bicknell* 257
New or little known Plants of the Southern States (PLATES 206–209): *T. H. Kearney, Jr.* 260
PAGE.
Cryptogamic Notes from Long Island—I.: *S. Ely Jelliffe* 266
A new *Selaginella* from Mexico: *Lucien M. Underwood* 268
BOTANICAL NOTES.—Pistillody of *Podophyllum* Stamen: *Byron D. Halsted* 269
REVIEWS.—Synopsis of Malveæ; Fossil Plants from the Great Falls Coal Field . . 270
PROCEEDINGS OF THE CLUB 271
INDEX TO RECENT LITERATURE RELATING TO AMERICAN BOTANY 272

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BULLETIN

OF THE

TORREY BOTANICAL CLUB.

Vol. 21. Lancaster, Pa., June 20, 1894. No. 6.

Thomas Morong.

BY N. L. BRITTON.

Thomas Morong, Curator of the Herbarium of Columbia College, died at Boston, Mass., April 26, 1894, after an illness of nearly four months. He had been troubled by a cough during the autumn of 1893, and in December, hoping for a speedy cure, accompanied Mr. John K. Small and the writer of this sketch, to Charleston, S. C., planning to remain for a few weeks in the South and return to his post before spring. But his malady was of a more serious character than he or any of his associates had supposed, and in January, while in Jacksonville, Fla., he was obliged to seek medical treatment, and for the next three months remained in St. Luke's Hospital in that city, improving a little at times so that he could be out of doors and enjoy the rapidly advancing season; but on the whole, failing in general health, so that, while he was favored with the best of medical attendance and care, it became evident by March that he could not recover. He came North about the middle of April, proceeding directly by rail to Boston, where he went to the house of his son, Dr. A. B. Morong, and there died within two weeks after his arrival.

He was too feeble to carry on much correspondence during his stay in Jacksonville, but the few letters written by him indicate that his cheerful, uncomplaining, happy disposition remained with him up to the last.

He was born at Cahawba, Ala., April 15, 1827, and his boyhood was spent in the South. On the death of his father, about

1842, his mother with a family of four sons removed to Woburn, Mass. He has frequently related to us his recollections of his first spring in Northern lands, having been particularly impressed with the beauty of the fruit trees in full bloom. We have heard him say that he was then, and until his majority, under the charge of a guardian. He was prepared for college at Woburn and Medford, entered Amherst, and was graduated from that institution in 1848. A portion of the year following was spent in the Law School of Harvard College, and in 1850 he became a member of Andover Theological Seminary, graduating in 1853, and being ordained a Congregational clergyman in 1854, a profession which he followed almost without intermission until 1888, preaching successively in Iowa City, Iowa, and Webster, Globe Village, Gloucester, Ipswich and Ashland, Mass.

It appears to have been association with William Oakes, of Ipswich, and Dr. J. W. Robbins, of Uxbridge, that first awakened in him a taste for botanical study. These diligent and critical students of the New England flora each furnished him with material for the nucleus of an herbarium, and from Dr. Robbins he received his entire collection of Naiadaceæ, with the understanding that Mr. Morong was to continue Dr. Robbins' researches on this group of plants—a trust that we know has been faithfully fulfilled.

All Mr. Morong's material of this order was incorporated by him with the herbarium which in later years came under his charge, and it there awaits a student who will continue the work begun by Dr. Robbins. The collection of these plants is one of the most complete in existence, almost every described species being represented, most of them abundantly.

The writer's first acquaintance with Mr. Morong was at the Buffalo meeting of the American Association for the Advancement of Science in 1886. He at that time spoke to me of a great desire to visit one of his brothers, a resident of Chile, and at the same time collect and study the flora of some portion of South America, he having been greatly impressed with the success of Dr. Rusby's Bolivian expedition. Some correspondence in relation to the plan passed between us subsequently, and we consulted with Dr. Allen during the New York meeting of the American Association the following year, with the result that between the three the expedition was arranged, and the explorer set out by sailing vessel for Paraguay in the summer of 1888.

A botanical collector was never better equipped. Even the wooden cases in which the collections were sent home were taken along in pieces with a supply of screws for fastening them together. After a necessarily uneventful voyage of 67 days, the vessel reached Buenos Ayres, and a few days were spent there in consultation with some of the local naturalists, and a few plants collected. But Paraguay was the region chosen, and within a few weeks the explorer was settled in Assumption, and immediately began the work of collecting and of carefully recording in note books all the gross features of the plants obtained. These note books were most systematically kept, and they enabled him on his return to write up the account of his collections in a manner which has rarely been equalled. With Assumption as a centre, Central Paraguay was carefully explored for nearly a year. Opportunity was then offered for an examination of the flora of the boundary region between Paraguay and the Argentine Republic along the Pilcomayo River, through the operations of a surveying party, which ascended that stream in a small steamer. Our friend gladly accepted the opportunity of accompanying the party in the capacity of naturalist, and the stream was ascended several hundred miles, the journey only being cut short by the lack of water in the upper reaches. After several months' absence, a safe return was effected to Assumption, all the botanical collections being brought down unharmed. After a few weeks more spent in and about Assumption, Mr. Morong proceeded to Buenos Ayres, and took passage on the steamer for Valparaiso, Chile. A stop was made at the Falkland Islands, and a few additions there made to the already very rich collections.

Joining his brother at Coquimbo, advantage was taken of the opportunity of studying the Atacama desert flora, and considerable collections made there and at other points in Chile. In the fall of 1890 he returned to the United States by steamer to the Isthmus, and thence to New Orleans and by rail to New York, having been absent considerably more than two years, during which time he had enjoyed continuous good health and encountered a great variety of pleasant experiences. He has frequently alluded to this trip as one of the pleasantest portions of his life, and regarded it as the means of greatly prolonging his days.

Letters written by him during his absence are proof of the enjoyment he had in his work. They also clearly indicated his wish to follow botany as his subsequent profession rather than to return to the ministry. It became possible for us to offer him the recreated position of Curator of the Columbia College Herbarium, which he gladly accepted, and he entered on its duties soon after his return. Naturally the first wish of all concerned was that he should record the results of his South American explorations, and these were gradually brought together and published during 1892 and 1893 as the 35th Contribution from the Herbarium which he had in charge; it is not usual for a botanical collector to have the satisfaction of working up and publishing his own material. At the same time he brought together matter for a narrative of the Pilcomayo Expedition, but this has not yet been put into type.

Mr. Morong's intimate knowledge of the Naiadaceæ and the trust accepted by him from Dr. Robbins made it very desirable that he should prepare a monograph of the North American representatives of that order. This was also successfully accomplished, and through the cordial coöperation of several friends it became possible to publish it with complete illustration in the third volume of the MEMOIRS of this Club. Incidentally he had paid close attention to other orders of aquatic Spermatophyta, and during his residence in New York he published descriptive accounts of the Halorageæ and Eriocaulaceæ. He had previously discussed Typhaceæ and Nymphæaceæ. During the autumn of 1893 he had been engaged in monographing the North American species of *Smilax*, and had prepared considerable manuscript, most of which can be printed, as well as a large amount of other material, all of which it is hoped may soon be permanently placed on record. He left scarcely any work which can be characterized as unfinished.

He was deeply interested in the work of the Torrey Club, being a frequent contributor to the interest of its meetings, active in its field operations, and for one season took charge of its summer course of instruction. He was elected a Vice-President in 1892, and continued in the office until his death.

His principal botanical publications are as follows:

New species of *Potamogeton* with Notes upon some published Forms. Bot. Gaz. **5**: 50–53 (1880).

Potamogeton Vaseyi Robbins. Bot. Gaz. **5**: 89 (1880).

Potamogeton Hillii n. sp. Bot. Gaz, **6**: 290, 291 (1881).

Notes on Naiadaceæ. Bot. Gaz. **10**: 254–256 (1885).

Collection of aquatic Plants. Bot. Gaz. **11**: 139, 140, 193 (1886).

Revision of the North American Species of *Nuphar*. Bot. Gaz. **11**: 164–169 (1886).

A new Species of *Potamogeton*. Bull. Torr. Bot. Club, **13**: 45 (1886).

Naiadaceæ in the Torrey Herbarium. Bull. Torr. Bot. Club, **13**: 153–162 (1886).

Some new or little known American Plants. Bull. Torr. Bot. Club, **14**: 51, 52 (1887).

Studies in the Typhaceæ. Bull. Torr. Bot. Club, **15**: 1–8; 73–81 (1888).

A new Water-lily. Bot. Gaz. **13**: 124, 125 (1888).

Paraguay and its Flora. Bot. Gaz. **14**: 222–227; 240–253 (1889).

First Glimpses of South American Vegetation. Bull. Torr. Bot. Club, **16**: 43–49 (1889).

The Flora of the Desert of Atacama. Bull. Torr. Bot. Club, **18**: 39–48 (1891).

Myriophyllum Farwellii n. sp. Bull. Torr. Bot. Club, **18**: 146, 147 (1891).

Horticulture in the Copiapo Valley, Chile. Amer. Gard. **12**: 227–230 (1891).

Jesuits' Tea. Bull Pharm. **5**: 549–554 (1891).

Copernicia cerifera. Bull. Pharm. **6**: (1892).

Notes on North American Halorageæ. Bull. Torr. Bot. Club, **18**: 229–246 (1891).

Notes on the North American Species of Eriocauleæ. Bull. Torr. Bot. Club, **18**: 351–362 (1891).

Eriocaulon bilobatum n. sp. Bull. Torr. Bot. Club, **19**: 226, 227 (1892).

An Enumeration of the Plants collected in Paraguay, 1888–1890, Annals N. Y. Acad. Sci. (1899–1893).

A Revision of the North American Naiadaceæ. Mem. Torr. Bot. Club, 3: Part. 2, pp. 65 (1893).

A new Species of *Listera* with notes on other Orchids. Bull. Torr. Bot. Club, **20**: 31–39, 121, 122 (1893).

Thomas Hogg. Bull. Torr. Bot. Club, **20**: 217, 218 (1893).

Notes upon various Species of Iridaceæ and other Orders. Bull. Torr. Bot. Club, **20**: 467–473 (1893.)

Mr. Morong was a most diligent and painstaking worker. He systematically came to his post at eight o'clock in the morning and remained until two in the afternoon. After lunch he never failed to take his hour's *siesta*, a Paraguayan habit which he thoroughly enjoyed, and was back again at work from four until eight or often later. Personally he was a delightful man, always cheerful, usually gay, overflowing with interesting, instructive and amusing remarks, generous to a fault and constantly mindful of the feelings and wishes of others. His death has lost to American Science one of its most earnest, critical and enthusiastic devotees, and to those who have been favored with his companionship a dear friend, a wise adviser, a beloved associate.

A Revision of the Genus Lechea.

BY N. L. BRITTON.

The genus *Lechea* was named by Kalm in 1751* in honor of John Leche, a Swedish botanist. Linnæus took it up in 1753, in the first edition of his "Species Plantarum," and there indicated two species, *L. minor* and *L. major*. His *Lechea major* proved to be a *Helianthemum*, thus leaving *L. minor* as the type of the genus. Michaux added several species in 1803. Spach discussed the order Cistaceæ in 1836, and in the same year appeared Rafinesque's monograph of the genus,† where twenty-one species are described. The genus was critically studied in the field and herbarium by Mr. Wm. H. Leggett for more than ten years prior to his death in 1882, but he published little concerning it, contenting himself for the most part with assigning provisional names to the forms which he thought should be maintained as species, and building up an immense collection of them from all parts of the country. From my intimate relations with Mr. Leggett I naturally took much interest in the plants, and upon his death all his material came into my possession. We had together pored over Rafinesque's monograph, endeavoring to determine which of his names belonged to the forms we could recognize as distinct, and had come to the conclusion that, unless the type specimens could be found, there could be no certainty in using any of them. I have, therefore, endeavored in recent years to ascertain if these types are in existence, but I have been quite unable to find in any of the herbaria of Europe or America a single authentic *Lechea* of Rafinesque. Durand's herbarium at the Jardin des Plantes, Paris, contains many of Rafinesque's plants, and the Delessert herbarium at Geneva many more, but I could find none of the *Lecheas*. Dr. Torrey had a good deal of material from him, but nothing of the genus. The collections of the Botanical Garden at Palermo, Italy, where some of Rafinesque's material was doubtless deposited, were burned some years ago, as Dr. Geo. G. Kennedy ascertained for me on his recent trip to the Mediterranean. Still Rafinesque expressly remarks that he had specimens of all his described species, and they may still turn up somewhere. If they do, some modifications of the names adopted in this paper will doubtless become necessary.

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*Linnæus, Nova Pl. Gen. 10; Amœn. Acad. 3: 10.

† New Fl. N. A. 89–98 (1836); reprinted by Leggett in Bull. Torr. Bot. Club, **6**: 246–252, with annotations.

The species so closely resemble each other that the brief characterizations of Linnæus, Michaux and Rafinesque are altogether inadequate to distinguish them, and I have been compelled to examine the type specimens in order to understand what authors have had in hand and reject the names of Rafinesque on account of my inability to correlate them with the species recognized by Leggett. This paper is, then, essentially based on the examination of type specimens. The results of Leggett's study of Rafinesque's monograph may be found by those interested in the BULLETIN, as above cited.

All the *Lecheas* which I have been able to examine in the field bloom very shyly, and the whole plant appears to come into flower at the same time. This occurs in bright sunshine, the petals are fugacious, and thus the flowers are of but little practical value in classification. The characters of the capsules and sepals seem to be constant, as are those of the leaves, both of the sterile, radical shoots and those of the stem and branches. The radical shoots appear in summer, apparently always after the time of flowering, and their leaves reach full development in autumn and early winter. The time to study the plants then, from a systematic standpoint, is in the late autumn.

The following key may serve as an aid to their rapid determination:

- Placentæ of the capsule fragile, separating from the thin dissepiments, their margins revolute.
  - Leaves of the radical shoots oblong or ovate, not more than about three times as long as wide.
    - Outer sepals longer than the inner; inflorescence leafy. 1. *L minor.*
    - Outer sepals equalling or shorter than the inner.
      - Capsule oblong; pedicels slender, 2–4 mm. long. 2. *L. racemulosa.*
      - Capsule globose; pedicels about 1 mm. long.
        - Erect; stem leaves large. 3. *L. villosa.*
        - Divaricately branched; stem leaves small. 4. *L. divaricata.*
        - Bushy-branched, tomentose-canescent. 5. *L. maritima.*
  - Leaves of the radical shoots lanceolate or linear, more than three times as long as wide.
    - Stem leaves narrowly linear; inner sepals 1-nerved. 6. *L. tenuifolia.*
    - Stem leaves filiform; Cuban. 7. *L. Cubensis.*
    - Stem leaves linear or linear-oblong; inner sepals 3-nerved.
      - Capsule 1 mm. in diameter; branches widely spreading or ascending. 8. *L. patula.*
      - Capsule 1.5 mm. in diameter.
        - Plant pale, canescent; branches nearly erect. 9. *L. stricta.*
        - Plants green; leaves glabrate; branches ascending.
          - Calyx densely covered with appressed, white hairs. 10. *L. Torreyi.*
          - Calyx merely strigose-pubescent. 11. *L. Leggettii.*
      - Capsule 2–2.5 mm. in diameter.
        - Outer sepals longer than the inner. 12. *L. tripetala.*
        - Outer sepals not longer than the inner. 13. *L. intermedia.*
- Placentæ crustaceous, the margins not revolute, dissepiments persistent; pedicels deflexed. 14. *L. Drummondii.*

Descriptions of the Species.

I. LECHEA MINOR L.

Lechea minor L. Sp. Pl. 90 (1753). (Type in Linnæan Herbarium.)

Lechea thymifolia Michx. Fl. Bor. Am. 1 : 77 (1803). (Type in Michaux Herabarium.)

Lechea Novæ-Cæsareæ Austin; A. Gray, Man. Ed. 5, 81 (1867). (Type in Columbia College Herbarium.)

Erect, 1.5–6 dm. high, freely branching above, more or less pilose-pubescent with slightly spreading hairs throughout. Branches slender, erect, ascending or the lower sometimes spreading; stem-leaves oval or oblong, 8–15 mm. long, 4–7 mm. wide, subacute or obtuse, ciliate, the upper smaller; petioles 1–2 mm. long; leaves of the radical shoots oval or oblong, obtuse, 6–10 mm. long, 5–6 mm. wide; panicle usually very leafy; flowers close together, somewhat secund; outer sepals longer than the inner and mostly exceeding the obovoid or globose capsule.

Occurs in dry fields and thickets, Eastern Massachusetts to Florida, west to Michigan and Louisiana.

Much search has been necessary in order to determine which of the forms should be regarded as the true *L. minor*. The species is badly mixed in the Linnæan herbarium. There are two sheets so marked. The first bears a fruiting specimen of the plant above described, with mature radical leaves, as well as the upper part of a fruiting plant of what I take up as *L. villosa* Ell., together with two specimens of mature, radical shoots of the same. The second sheet carries an immature specimen of *L. maritima* Leggett, marked by Sir J. E. Smith "racemulosa Michx." Pinned to this sheet is another, bearing a plant too young for satisfactory determination, marked "eadem" by Smith, not marked by Linnæus.

There are also two sheets not marked by Linnæus. One of them has a specimen of a very young plant of a specimen marked "racemulosa Michx," by Smith; the other carries specimens of what I here take as the true *L. minor*, and evidently the type of the second synonym given by Linnæus in the "Species Plantarum," as it is labeled "Capraria fol. integerrimis, fl. virg."

It will thus be seen that not a bit of the plant which appears as *L. minor* L. in current American text-books entered into the original description of the species.

Sir J. E. Smith apparently regarded the species which I take up as *L. villosa* Ell. (*L. major* Michx., not L.) as the true *L. minor*, and previously to my examination of the Linnæan types I had taken this view, and it so appears in my Catalogue of Plants found in New Jersey. But I was unable to trace this to any of the synonyms cited by Linnæus, and while it is clearly a part of the original, it seems to me that the name more properly belongs to the species as characterized above.

2. LECHEA RACEMULOSA Michx.

Lechea racemulosa Michx. Fl. Bor. Am. **1**: 77 (1803). (Type in Michaux Herbarium).

Erect, 1.5–4.5 dm. high, freely branching above, slightly pilose-pubescent throughout with appressed hairs. Branches slender, divergent or ascending; leaves of the stem oblong or linear-oblong, obtuse or subacute, narrowed at the base, 8–20 mm. long, 3–4 mm. wide; leaves of the radical shoots oval or oblong, 4–8 mm. long, 3–6 mm. wide, obtuse; petioles about 2 mm. long; panicle sparsely leafy; flowers oblong on slender, divergent pedicels 2–4 mm. long; outer sepals equaling or shorter than the inner; capsule ellipsoid.

In dry, sandy and rocky soil, Martha's Vineyard to South Carolina, west to Indiana and Tennessee.

3. LECHEA VILLOSA Ell.

Lechea major Michx. Fl. Bor. Am. **1**: 76 (1803), not L. (Type in Michaux Herbarium.)

Lechea villosa Ell. Bot. S. C. & Ga. **1**: 184 (1817). (Type in Elliott Herbarium.)

Erect, stout, villous-pubescent with spreading hairs, 3–6 dm. tall, branching above or sometimes throughout, leafy. Branches ascending or the lower sometimes spreading; leaves of the stem oblong-elliptic, obtuse but pointed, 1½–2½ cm. long, 6–10 mm. wide; petioles 1 mm. long; leaves of the radical shoots broadly oblong, obtuse, 6–8 mm. long, 4–6 mm. wide; ultimate branchlets often recurved; pedicels 1 mm. long; flowers more or less secund-scorpoid, close together; outer sepals about equaling the inner; capsule depressed-globose, 1 mm. in diameter.

In dry fields, Massachusetts to Florida, west to Southern Ontario, Illinois and Texas.

4. LECHEA DIVARICATA Shuttlw.

Erect, divaricately branched, branches slender, very leafy, densely villous-pubescent. Leaves of the stem and branches small, 4–8 mm. long, oval, oblong or linear-oblong, acute, clothed with spreading hairs on both surfaces; inflorescence very leafy; flowers obovoid; pedicels about 2 mm. long, not secund; outer sepals shorter than the inner; capsule globose, nearly 2 mm. in diameter.

Florida (Rugel, Garber, Curtiss), Texas (E. Palmer, No. 2025).

Distributed under the above name by Shuttleworth from Rugel's Florida collections, but apparently here first described. I have not seen the radical shoots and am consequently uncertain of the alliance of the species, but think there is little doubt of its near relationship to *L. villosa*.

5. LECHEA MARITIMA Leggett.

Lechea thymifolia Pursh, Fl. Am. Sept. 91 (1814), not Michx. (Type in the Kew Herbarium.)

Lechea maritima Leggett; Britton, Prel. Cat. N. J. 13 (1881). (Type in Columbia College Herbarium.)

Lechea minor var. *maritima* A. Gray, Man. Ed. 6, 77 (1890). (Type in Gray Herbarium.)

Densely tufted, branching from the base, stout, rigid, 1.5–3 dm. tall, tomentose-canescent with whitish hairs. Primary branches spreading or ascending, numerous; flowering branches slender, divergent, elongated; leaves of the stem linear or linear-oblong, obtuse or acute, 8–20 mm. long, 2–4 mm. wide; leaves of the radical shoots oblong or ovate-oblong, 6–8 mm. long, 3–5 mm. wide, densely canescent; pedicels 1 mm. long; flowers densely clustered; outer sepals slightly shorter than the inner; capsule globose, 1 mm. in diameter.

In sands of the sea-shore and in sandy pine barrens, Massachusetts to Georgia. Apparently also at the Crawford Notch, White Mountains of New Hampshire.

The radical shoots of this species do not begin to form until late autumn and are not fully developed until December.

6. LECHEA TENUIFOLIA Michx.

Lechea minor var. γ T. & G. Fl. N. A. 1: 154 (1838). (Type in Columbia College Herbarium.)

Lechea tenuifolia Michx. Fl. Bor. Am. 1: 77 (1803). (Type in Michaux Herbarium.)

Lechea thesioides Spach, Comp. Bot. Mag. **1**: 284 (1835). (Type in Paris Herbarium.)

Densely tufted, stems erect, slender, 1–2.5 dm. high, divaricately branched above, minutely strigose-pubescent. Branches slender, elongated; leaves of the stem narrowly linear or nearly filiform, 4–15 mm. long, 1 mm. or less wide, acute, sessile, or very nearly so; leaves of the radical shoots linear, sessile, 6–8 mm. long, about 1 mm. wide; pedicels 2 mm. long; flowers more or less secund, bracted by the minute upper leaves; outer sepals equalling or slightly exceeding the inner; capsule globose, 1 mm. or a little more in diameter.

In dry, open places, Eastern Massachusetts to Wisconsin, south to Florida and Texas.

7. LECHEA CUBENSIS Leggett.

Lechea Cubensis Leggett, Bull. Torr. Club, **6**: 252 (1878). Type in Columbia College Herbarium.)

Erect, branched, 1–1½ dm. high, finely appressed-pubescent throughout, the branches filiform, ascending. Leaves of the stem and branches filiform, 4–8 mm. long, scarcely 0.5 mm. wide; flowers oblong, not secund; pedicels filiform, 4–6 mm. long; outer sepals slightly shorter than the inner; capsule globose, about 1 mm. in diameter.

Cuba (C. Wright, No. 3518).

This interesting species, known to me only from one collection, is placed next to *L. tenuifolia*, but the material for examination is too meagre to afford a satisfactory diagnosis. It is certainly distinct from any of the rest. Its radical shoots are unknown.

8. LECHEA PATULA Leggett.

Lechea patula Leggett, Bull. Torr. Club, **6**: 251 (1878). (Type in Columbia College Herbarium).

Bushy, usually divergently branched, but branches sometimes ascending, appressed-pubescent, 1.5–4.5 dm. high. Leaves of the stem and branches linear or oblong, acute, 4–9 mm. long, 1 mm. or less wide; leaves of the radical shoots canescent, linear-oblong or somewhat spatulate, subacute, 6–10 mm. long, 1–2 mm. wide; flowers minute, globose; outer sepals about equalling the inner; capsule globose, 1 mm. in diameter.

Florida and South Carolina.

This was distributed by Shuttleworth from Rugel's collections as *L. nana*.

9. LECHEA STRICTA Leggett.

Erect, strict, 3–5 dm. tall, densely branched, pale, strigose-canescent all over or more glabrate in age. Branches slender, straight, nearly erect; leaves of the stem linear-oblong, 1–2.5 cm. long, 1–2 mm. wide, acute or subobtuse; leaves of the radical shoots linear-oblong, much smaller than those of the stem, 4–7 mm. long, 1 mm. or less wide, acute; pedicels 2–3 mm. long; outer sepals shorter than or equalling the inner; capsule globose, 1.5 mm. in diameter.

On dry prairies, Illinois, Wisconsin and Iowa.

10. LECHEA TORREYI Leggett.

Lechea Torreyi Leggett; S. Wats. Bibl. Index, 1: 81 (1878). (Types in Columbia College Herbarium.)

Lechea racemulosa Hook. Journ. Bot. 1: 193 (1834), name only, not Michx.

Cinereous-pubescent, much branched, 2.5–4.5 dm. high, the branches ascending. Leaves of the stem and branches linear, 8–12 mm. long, about 2 mm. wide, acute, those of the radical shoots smaller and narrower, finely appressed-pubescent; flowers numerous, short-pedicelled; calyx densely covered with appressed white hairs; capsule obovoid or subglobose, 1.5 mm. in diameter; outer sepals shorter than the inner.

Florida and South Carolina.

11. LECHEA LEGGETTII Britt. & Holl.

Lechea minor Lam. Tabl. Encycl. *t. 52, f. 1* (1791), not L.

Lechea Leggettii Britt. & Holl. Prel. Cat. N. Y. 6 (1888). (Types in Columbia College Herbarium.)

Lechea Leggettii var. *pulchella* Britt. & Holl. Prel. Cat. N. Y. 6 (1888).

Erect, rather slender, freely branched, somewhat strigose-pubescent or nearly glabrous, 2.5–5 dm. tall. Branches slender, spreading or ascending; leaves of the stem linear or linear-oblong, acute or obtuse, 1–2.5 cm. long, 1–2 mm. wide, sessile or nearly so; leaves of the radical shoots oblong-linear, 4–6 mm. long, 1 mm. wide, acute; panicle open, its slender branches divergent; flowers somewhat secund; pedicels 1–2 mm. long; outer sepals about equalling the inner; capsule obovoid or subglobose, 1.5 mm. in diameter.

In dry soil, Long Island, N. Y., to Indiana, south to Virginia and Pennsylvania.

The nearest affinity of this species is with the preceding, with which I have sometimes thought of uniting it. It was distributed as *L. Torreyi* in Mr. Heller's Virginia collections of 1893.

12. LECHEA TRIPETALA (Moc. & Sesse).

Helianthemum tripetalum Moc. & Sesse; D.C. Prodr. 1: 284 (1824). (Founded on unpublished plate of Mocino and Sesse).

Lechea Skinneri Benth. Bot. Voy. Sulph. 99 (1844). (Type in Kew Herbarium.)

Low, 7–15 cm. high, much branched, clothed with long, whitish, appressed hairs. Leaves of the stem and branches filiform or linear, acutish, 8–10 mm. long, mm. or less wide; "leaves of the radical shoots narrower, appressed-canescent with long hairs;" flowers short-pedicelled; outer sepals subulate, longer than the inner, all densely pubescent; capsule depressed-globose, 2–2.5 mm. in diameter.

Guatemala (Skinner); San Luis Potosi (Parry and Palmer, No. 31); near Guadalajara, Jalisco (Pringle, No. 4496).

13. LECHEA INTERMEDIA Leggett.

Lechea Leggettii var. *intermedia* Britt. & Holl. Prel. Cat. N. Y. 6 (1888), name only.

Erect, strict, 2–5 dm. tall, branching above, sparingly strigose-pubescent. Branches nearly erect, short, slender; leaves of the stem oblong-linear, 1–2 cm. long, 2–3 mm. wide, acute, nearly sessile; leaves of the radical shoots oblong-linear, shorter than those of the stem, 8–10 mm. long, 1 mm. wide, somewhat larger than those of *L. Leggettii;* pedicels 2–4 mm. long, slender; outer sepals not longer than the inner; capsule globose or depressed-globose, 2 mm. in diameter.

In dry, mostly rocky soil, New Brunswick and Ontario to Pennsylvania.

This very well marked species is almost confined to hilly or mountainous districts. Its radical shoots are mature in November.

14. LECHEA DRUMMONDII (Spach) T. & G.

Lecidium Drummondii Spach, Comp. Bot. Mag. 1: 287 (1835). (Type in the Paris Herbarium.)

Lechea Drummondii T. & G. Fl. N. A. 1: 154 (1838). (Type in Columbia College Herbarium.)

Linum Sansabeanum Buckl. Proc. Acad. Phila. 1861, 450 (1861), according to Gray.

Sparingly pubescent, 1–2 dm. high, stems slender, wiry, much branched, decumbent or erect, the branches ascending. Leaves narrowly linear, 6–12 mm. long, 0.5 mm. wide, scattered, the upper minute; flowers solitary in the axils of the subulate upper leaves, secund, slender-pedicelled, the pedicels deflexed and 2–4 mm. long in fruit; calyx strigose-pubescent, the outer sepals about as long as the inner; capsule depressed-globose, 2 mm. in diameter.

Texas (Drummond, No. 19; Wright; Lindheimer, No. 16; Berlandier, Nos. 631, 1028, 2041, 2458; E. Hall, No. 31; Curtiss' N. A. Plants, No. 232; Sabine River, Leavenworth).

Fossil Salvinias, including Description of a new Species.

By Arthur Hollick.

(Plate 205.)

The genus *Salvinia* is represented in the flora of to-day by thirteen recognized species, which are, with the single exception of *S. natans* (L.) All., confined to tropical regions. This latter species is well known in Europe and Asia, and has been found or reported from four localities in North America, viz.: Western New York and Missouri (*fide* Gray's Manual, 6th Ed., 701 [1890]); Minnesota (Conway MacMillan, Bull. Torr. Bot. Club, **18**: 13 [1891]); Southeastern New York (Thos. Craig, Proc. Nat. Sci. Assn. S. I., Oct. 14, 1893). In all these localities, however, the indications are that the plant was introduced, and that it is not native on this continent.

In the fossil state the genus has been well identified from recent geological horizons—upper cretaceous and tertiary—in Europe and America, and thirteen species have been described.[*]

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[*] 1. *Salvinia reticulata* (Ettingsh. in part), Heer, Fl. Tert. Helvetiæ, **3**: (1859), 156, *pl. 145, f. 16.* (*Dalbergia reticulata* Ettingsh. Beitr. z. Kenntniss d. Foss. Fl. v. Tokay, Sitzb. d. K. Akad. Wiss. Wien, Math.-Nat. Cl. **11**: (1853), 813, *pl. 4, f. 5*).

2. *Salvinia Mildeana* Gœpp. Tert. Fl. v. Schossnitz in Schlesien (1855), 5, *pl. 1, f. 21–23;* Unger, Syll. Pl. Foss (1860), 5, *pl. 1, f. 7–10;* Ettingshausen, Foss. Fl. d. Tert.-Beck. v. Bilin, Denkschr. d. K. Akad. d. Wiss. Wien, Math.-Nat. Cl. **26**: (1866), 94, *pl. 2, f. 23;* Heer, Miocene Baltische Fl. (1869), 17, *pl. 3, f. 1, 1b, 2.*

Ten of these are from Europe and three from America. It is doubtful if they should all be retained in the genus, but most of them are too well defined to admit of any doubt as to their botanical affinities.

The new species here described was recently brought to light while examining a quantity of undetermined material collected in 1883–'84, at Carbonado, Wash., by Mr. Edward Lorrance, under the direction of the late Professor J. S. Newberry. The specimens include about fourteen individuals, perfect and fragmentary, and upon some of them I found labels, in Professor Newberry's handwriting, with the name *Salvinia elliptica*, n. sp., which name I have retained. The best ones are figured in the accompanying plate, together with an enlargement to show the arrangement of the pits, and a figure of each of the other fossil species thus far described, for purposes of comparison. In this latter connection I wish to acknowledge my indebtedness to Professor Lester F. Ward, of the United States Geological Survey, for references to several species which I should have otherwise missed.

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3. *Salvinia formosa* Heer, Fl. Tert. Helvetiæ, l. c. *f. 13, 13b, 15;* Velenovsky, Fl. a. d. Ausgebr. Tert. Let. v. Vrsovic bei Laun (1881), 12, *pl. 1, f. 14–17;* Zittel, Handb. d. Palæontologie, 2: (1890) *f. 118 (3)*.

4. *Salvinia cordata* Ettingsh. Foss. Fl. d. Tert.-Beck. v. Bilin, l. c. *f. 19, 20;* Zittel, l. c. *f. 118 (1)*.

5. *Salvinia Reusii* Ettingsh. l. c. *f. 21, 22;* Zittel, l. c. *f. 118 (2)*.

6. *Salvinia Alleni* Lesq. Tert. Fl. (1878), 65, *pl. 5, f. 11;* Cret. & Tert. Fl (1883), 136, *pl. 21 f. 10, 11*. (*Ophioglossum Alleni* Lesq. Hayden's U. S. Geol. & Geog. Surv. Ann. Rept. (1872), 371).

7. *Salvinia cyclophylla* Lesq. Hayden's U. S. Geol. & Geog. Surv. Ann. Rept. (1873), 408; Tert. Fl. (1878), 64, *pl. 5, f. 10, 10a.*

8. *Salvinia attenuata* Lesq. Hayden's U S. Geol. & Geog. Surv. Ann. Rept. (1874), 296; Tert. Fl. (1878), 65, *pl. 64, f. 14, 14a.*

9. *Salvinia Ehrhardti* Probst, Beschr. d. Foss. Pflanzenreste a. d. Molasse v. Heggbach O. A. Biberach etc. Jahresh. d. Ver. f. Vaterl. Naturk. i. Wurttemberg, 40: (1884), 74, *pl. 1, f. 3.*

10. *Salvinia excisa* Probst, l. c. *f. 4.*

11. *Salvinia spinulosa* Probst, l. c. 75, *pl. 1, f. 5.*

12. *Salvinia oligocænica* Staub, Aquitanische Fl. d. Zsilthales, Jahrb. d. K. Ungar. Geol. Anst. 7: (1887), 235 (15), *pl. 19, f. 2, 2a.*

13. *Salvinia aquensis* Sap. Ann. Sci. Nat. 7e Ser. Bot. 7: (1888), 27, *pl. 2, f. 1, 1a, 1b.*

SALVINIA ELLIPTICA Newb.

Pl. 205, f. 14, 14a, 15.

Leaves small, $\frac{1}{2}$–$\frac{5}{16}$ in. long, $\frac{3}{8}$–$\frac{1}{4}$ in. wide, elliptical to almost orbicular in outline, cordate at base, more or less emarginate at apex; midrib well defined; surface marked with relatively large but few pits, arranged in rows, which radiate from the midrib at an acute angle upward.

Formation and locality: upper cretaceous (?) Carbonado, Washington.

This beautiful little *Salvinia* is clearly distinct from any species hitherto described. In outline the larger specimens do not differ much from S. *Mildeana* Goepp.*[2] (f. 5), and the smaller ones approach the forms of *S. cordata* Ettingsh.*[4] (f. 7), *S. formosa* Heer *[3] (f. 6) and *S. Ehrhardti* Probst. *[9] (f. 2), but from all of these it may be readily distinguished by its few large pits, as compared with the numerous small ones of the species mentioned. It is, perhaps, more nearly like the latter, all things considered. *S. spinulosa* Probst.*[11] (f. 4) is different both in size and shape, and the others offer no pretence for comparison whatsoever; in fact, we may well doubt whether some of these should be retained in the genus. The peculiar, reticulate nervation and absence of pit markings in *S. Alleni* Lesq.*[6] (f. 12), *S. reticulata* (Ettingsh. in part), Heer *[1] (f. 13) and *S. cyclophylla* Lesq.*[7] (f. 11), at once serve to separate them from all the others, and the latter is especially open to suspicion on account of its well defined midrib with irregular, pinnately arranged branches—a structure entirely foreign to the genus. It is significant that *S. reticulata* was originally described as a pod of *Dalbergia*, and *S. Alleni* as a leaf of *Ophioglossum*, while *S. cyclophylla* would not be described to-day as a *Salvinia*. All but the latter one of these three are, however, so very close in form, nervation and apex, to *Tmesipteris* Bernh., especially in the case of *S. Alleni*, that I wonder at their never before having been recorded in this connection.

S. oligocænica Staub *[12] (f. 1) and *S. aquensis* *[13] (f. 9) are too fragmentary and imperfect for exact comparison, but they appear to be more or less closely allied. *S. attenuata* Lesq.*[8] (f. 10) is unique, on account of its lack of any midrib, and the nervation which extends from base to summit. Were it not for the apparent pit markings it would be strikingly like two lobes of a *Marsilea* leaf. *S. excisa* Probst *[10] (f. 3) seems undoubtedly to represent nothing more than a pinnule of some fern, probably an *Asplenium*.

In view of the above facts, the following rearrangement of the species seems advisable:

SALVINIA (Micheli) Schreb.

S. Mildeana Goepp. (1855).
S. formosa Heer (1859).
S. cordata Ettingsh. (1866).
S. Reusii Ettingsh. (1866).
S. Ehrhardti Probst (1884).
S. spinulosa Probst (1884).
S. oligocænica Staub (1887).
S. aquensis Sap. (1888).
S. elliptica Newb. (1894).

MARSILEA Linn.

M. ATTENUATA (Lesq.) = *Salvinia attenuata* Lesq. (1874).

TMESIPTERIS Bernh.

T. RETICULATA (Ettingsh. in part) = *Dalbergia reticulata* Ettingsh. (1853); *Salvinia reticulata* Heer (1859).

T. ALLENI (Lesq.) = *Ophioglossum Alleni* Lesq. (1872); *Salvinia Alleni* (1878).

PHYLLITES Sterub.

P. CYCLOPHYLLA (Lesq.) = *Salvinia cyclophylla* Lesq. (1873).

ASPLENIUM L.

A. EXCISA (Probst) = *Salvinia excisa* Probst (1884).

Explanation of Plate 205.

Fig. 1. *Salvinia oligocænica* Staub, Jahrb. K. Ungarn. Geol. Anst. 7: *pl. 19, f. 2.*

Fig. 2. *Salvinia Ehrhardti* Probst, Jahresh. Ver. Vaterl. Naturk. Württemb. 40: *pl. 1, f. 2.*

Fig. 3. *Salvinia excisa* Probst, l. c. *f. 4.*

Fig. 4. *Salvinia spinulosa* Probst, l. c. *f. 5.*

Fig. 5. *Salvinia Mildeana* Goepp. Ung. Syll. Pl. Foss. *pl. 1, f. 7.*

Fig. 6. *Salvinia formosa* Heer, Fl. Tert. Helvetiæ, 3: *pl. 145, f. 13.*

Fig. 7. *Salvinia cordata* Ettingsh. Foss. Fl. Tert.-Beck. Bilin, *pl. 2, f. 19.*

Fig. 8. *Salvinia Reusii* Ettingsh. l. c. *f. 21.*

Fig. 9. *Salvinia aquensis* Sap. Ann. Sci. Nat. 7e Ser. Bot. 7 : *pl. 2, f. 1.*

Fig. 10. *Salvinia attenuata* Lesq. Tert. Fl. *pl. 64, f. 14.*

Fig. 11. *Salvinia cyclophylla* Lesq. Tert. Fl. *pl. 5, f. 10.*

Fig. 12. *Salvinia Alleni* Lesq. Cret. & Tert. Fl. *pl. 21, f. 11.*

Fig. 13. *Salvinia reticulata* (Ettingsh. in part) Heer, Sitzb. K. Akad. Wiss. Wien, 11 : *pl. 4, f. 5.*

Figs. 14, 14*a*, 15. *Salvinia elliptica* Newb. (*f. 14a*=nat. size × 2).

On a Species of Helianthemum not recognized in our Text-Books.

By Eugene P. Bicknell.

Although but one species of *Helianthemum* is recognized in the flora of the Eastern States north of New Jersey, I am fully satisfied that two species inhabit the region, closely related species, it is true, but, as I shall hope to show, perfectly distinct plants. Singularly enough, the more common of these plants is the one which has been overlooked, at least the less common plant, as I have encountered the two about New York, is unmistakably the one mainly intended by our text-books under the name *H. Canadense* Michx., though in some descriptions it is evident that the two plants have been confused.

With recent writers the name *H. Canadense* Michx. has given place to *H. majus* (L.), B. S. P., the latter name being clearly available under the belief which has all along been entertained that there existed but a single Eastern species of the genus. Now, however, that a second species presents itself to be reckoned with, the question of the availability of the name *majus* revives under an entirely new aspect. Indeed there would seem to be a fair probability that the name *Canadense* will be found to hold for the plant of our text-books, and that the name *majus* will be available for the species here brought forward. This view is perhaps fairly inferable from the following considerations: It is, of course, well understood that the apetalous state of a *Helianthemum* was by Linnæus mistaken for a *Lechea* and named by him *Lechea major.* This name having priority in "Species Plantarum" over *Cistus Canadensis*, which it has always been taught was merely the earlier flowering stage of the same plant, has been adopted for the supposed single species of *Helianthemum* inhabiting the "Canada" of that day. As a matter of fact, however, the apetalous state of true *H. Canadense* Michx., as here defined, does not closely resemble a *Lechea*, while the corresponding state of the newly recognized species is, in a marked degree, suggestive of a plant of that genus. Indeed, I have only lately, while searching for the dead winter stems of the *Helianthemum*, mistaken them for those of *Lechea major* Michx., and at first passed them by, an oversight which no one, I think, would be likely to commit in the case of true *H. Canadense.* It would appear, therefore, not at all improbable that the *Helianthemum* described by Linnæus as *Lechea major* was in reality the plant here in view, and that his *Cistus Canadensis* was after all a different plant. An examination of the type specimens in the Linnæan herbarium can alone settle the question, and may prove that the plant here called *majus* requires a different name; but for the purpose of more easily handling the plants in this note, I adopt provisionally the name *H. majus* (L.), for the newly recognized plant, reserving the name *H. Canadense* for our well-known Eastern species.

HELIANTHEMUM CANADENSE (L.) Michx.

From three inches to, rarely, two feet high, the primary flowers borne at a height of from four to twelve inches; erect, or occasionally very low and a little depressed; branches few, slender, often somewhat flexuous, commonly several inches long, and sometimes reaching a length of ten inches, simple or again branched; stem and branches at first pale, becoming reddish or purplish with age, loosely pubescent, or weakly hirsute with irregularly spreading stellate hairs, becoming hoary with close pubescence above, glabrate when old; leaves from near the base of the stem, on very short petioles, alternate narrowly oblong, or somewhat oblanceolate, obtuse, or sometimes acute, averaging less than an inch long by 3″ wide, an extreme size being 15″ x 4″, margins at length revolute; below hoary with stellate pubescence, green above but clothed with short stellate hairs, the upper surface becoming harsh and scabrous; primary flower large, solitary, at first sub-terminal, but subsequent development of the plant leaves it in the axil of a branch or in the angle of the widely bifurcated stem, where, later in the season, the remains of the capsule may be found; occasionally a second solitary flower is produced some distance above the first; pedicel of the flower slender, 2″ to 6″ long; calyx finely pubescent and more or less loosely pilose; narrow outer sepals much shorter than the inner;

flower large, bright yellow, 9″–15″ broad; capsule 3″ to 4″ long, ovoid, or obovoid, rounded above; apetalous flowers borne at short intervals along the branches, either singly or in peduncled clusters, which are sometimes closer and more numerously flowered above, but never closely aggregated; outer sepals very short and appressed, or rudimentary; fruiting calyx depressed-globose; capsule globose-triangular, at full maturity spreading 1½″ to 2″ broad (late in the season some terminal flowers may be imperfectly petaliferous, producing capsules which spread 3″), mostly three to many seeded; seeds reddish brown, finely and evenly papillose, the papillæ prominent under the microscope and often disposed in regular lines.

HELIANTHEMUM MAJUS (L.).

Taller, stouter and stricter than *H. Canadense*, from one to two feet high; branches more numerous, simple, much shorter, and never at all flexuous, commonly but one to two inches long, often less, only exceptionally reaching a length of four inches; entire plant more hoary canescent than in *Canadense*, with finer and closer stellate pubescence, especially on the primary inflorescence, and without the scattering of longer looser hairs usually seen in that species; more closely leafy, the leaves less spreading, frequently sub-opposite, or even sub-verticillate, on the stem; longer and relatively narrower, more tapering at base and apex, and on slightly longer petioles, the strong tendency to revolute margins seen in *Canadense* scarcely manifest; furthermore, the leaves are thicker and of softer texture, and wilt soon after being gathered, which is not the case with the stiffer and harsher leaves of the contrasted plant; stem reddish from the first, and early naked for several inches at the base; primary petaliferous flowers pale yellow, smaller than in *Canadense*, several to many (5 to 12), bracteolate in one to three slender cymose racemes, commonly 1½ inches long, terminating the simple stem, the axillary branches developing later but rarely overtopping the primary inflorescence; sepals densely downy canescent or softly pubescent, smaller and less acute than in *Canadense*, the narrow outer sepals as long as the inner or nearly so, instead of much shorter; capsules 1½″ to 2″ long, conspicuously triangular, broadly ovate and abruptly short pointed; clusters of apetalous flowers very short peduncled, appearing sessile, somewhat separated and mostly two to several-flowered low on the branches, above becoming more approximate and compound, and aggregated into dense, oblong, many-flowered, leafy heads terminating the short branches; frequently the branches are crowded with clusters of small leaves and apetalous flowers; in this condition the plant bears strongly the aspect of a *Lechea*; capsules of secondary flowers at full maturity spreading ¾″ to 1¼″, more oblong and pointed than in *Canadense*, of a deeper color and with a more polished surface, mostly one to three-seeded; seeds pale, yellowish-brown, finely and evenly reticulated, the network on the angles tending to break up into a papillose roughness.

H. Canadense I find in poor, light or sandy soil, often on or near rocks, and in partly shaded situations; *H. majus* grows in dry open ground, never on rocks or in shade, as far as I have observed. It comes into flower about the fourth week of June, two or three weeks later than *Canadense*, which, in the same neighborhood, may be found with full-sized pods before *majus* shows the first signs of flower-buds.

It should be said that these observations apply to the plants as they occur in the vicinity of New York, where also the specimens were collected from which the foregoing descriptions are drawn. The general distribution of the two plants, and their relative abundance, now become subjects of much interest in regard to which it is to be hoped that early information will be forthcoming. I may add that at York Harbor, Maine, in August last, *H. majus* was found to be a common plant over the downs near the sea, while *H. Canadense* was not met with.

RIVERDALE ON HUDSON, NEW YORK CITY.

New or little known Plants of the Southern States.

BY T. H. KEARNEY, JR.

(PLATES 206–209.)

GALIUM PARISIENSE L. Sp. Pl. 108 (1753).

Galium Anglicum Huds. Fl. Angl. Ed. 2, 69 (1778).

Abundantly naturalized in dry, sandy fields about Knoxville, Tenn. June–August.

DISPORUM MACULATUM (Buckley) Britton, Bull. Torr. Club, 15: 188 (1888).

Collected near Knoxville, Tenn. Grows in rich soil on bluffs of the Tennessee River. Also along the Emory River, near Harriman, Roane Co. April.

CORALLORHIZA WISTERIANA Conrad, Journ. Acad. Phila. **6**: 145 (1829).

Stem slender, light brown, 20–35 cm. high, bearing several sheathing, scale-like leaves; raceme 6–15-flowered; flowers 15 mm. long, slender-pedicelled, erect; lip white with conspicuous crimson spots, 8–10 mm. long, 4–5 mm. broad below the middle, abruptly clawed, ovate, narrowed towards the more or less notched apex, truncate at base, crenulate; lamellæ two short, prominent ridges; spur a more or less conspicuous protuberance adnate to the summit of the ovary; column strongly two-winged towards the base; capsule elliptic-oblong to oblong-obovoid, about 1 cm. long, drooping when mature.

New England: Robbins; Pennsylvania: near Philadelphia, Wister, Carsons; Mercersburg, Porter; Delaware: Wilmington, Canby; Georgia: Chapman; Florida: Chapman; Merritt's Island, A. H. Curtiss (No. 2816, distributed as *C. odontorhiza*); Alabama: Tuscaloosa, Johnson; Texas: Wright; Tennessee: Dandridge, Rugel; Knoxville, Kearney; Ohio: Cincinnati, Lea.

Corallorhiza Wisteriana has been referred by most recent botanists to *C. odontorhiza*, but is beautifully distinct. It may be recognized by its usually taller and more robust stem, flowers two or three times larger, lip less rounded, notched at apex, truncate and more abruptly clawed at base, with the lamellæ much more prominent, the distinct protuberance of the spur, and the prominent wings at the base of the column. There is also a marked difference in its period of flowering,—from February to May, while *C. odontorhiza* flowers from July to October. It appears to be more common than *C. odontorhiza*, especially southward.

CASTANEA NANA Muhl. Cat. 86 (1813).

Fagus pumila var. *præcox* Walt. Fl. Car. 233 (1788), *fide* Elliott (name only).

Castanea alnifolia Nutt. Gen. **2**: 217 (1818).

This species has been reduced to *Castanea pumila* by those later-day botanists who have made a practice of "lumping" plants with which they are not familiar into some well-known species. But the best botanists of the early part of the century—Muhlenberg, Nuttall, Elliott—agreed as to its validity. It is difficult to conceive how any one with Elliott's excellent description before him could have slighted its claim to such rank.

During the past summer I collected this plant near Jesup, Wayne County, Georgia, and was struck by its utter dissimilarity to *C. pumila.* It may be described as follows:

Stem simple or little branched, 3–5 dm. high, slender, glabrous below, downy-pubescent above, as are the branches, petioles and peduncles; bark dull gray-brown; leaves large in proportion to the size of the plant, 12–15 cm. long, 5–6 cm. broad, oblong or oblong-obovate, acuminate or more often obtuse at apex, rounded at base, coarsely sinuate-dentate with short, spreading and rigid teeth, thick, almost coriaceous, upper surface dark green, glabrous and shining, lower surface covered with a short, dense, rather tawny, or, at least, not bright-white down; petioles 4–5 mm. long; mid-nerve prominent, primary veins 12–15 pairs, disposed at irregular intervals, branching and often recurved at the ends; peduncles elongated, bearing numerous, rather remote clusters of staminate flowers above and a few pistillate flowers below; "involucrum of the fertile florets 1–3, on the lower part sterile. Ament generally maturing as in the preceding species [*C. pumila*]. The nut is generally much larger but less abundant than those of the preceding species."*

Differs from *C. pumila* in the dwarf habit, broader leaves, which are oblong or obovate-oblong and usually obtuse, while those of *C. pumila* are usually ovate-lanceolate and acuminate, in the shorter, more rigid and more spreading teeth, in the shining upper surface of the leaf and the more tawny hue of the down on the lower surface and in the shorter petioles.

Georgia: Jesup, Kearney; Florida: Jamony, Rugel; Louisiana: Red River, Hale. Flowers in May (Plate 206).

SPIRÆA VIRGINIANA Britton, Bull. Torr. Club, **17**: 314 (1890).

This well-marked *Spiræa* grows in considerable quantity on cliffs of loose shale in the Gap of the Chilhowee Mountain, through which the Little River flows in Blount County, Tennessee. Collected in June, 1891, and again in June, 1893.

SAXIFRAGA GRAYANA Britton, Mem. Torr. Club, **5**: 178 (1894).

Saxifraga Caroliniana A. Gray, Mem. Am. Acad. (II.) 3: 39 (1848), not Schleich.

Abundant on limestone cliffs on the Tennessee River at Knoxville (altitude about 900 feet). Flowers in April. Although the Knoxville plant has a spreading calyx, it corresponds in every other respect with Gray's type from Grandfather Mountain, North Carolina, and with specimens collected on Walker Mountain, Va., by members of the Torrey Club in May, 1892.* It is larger in every way and more hairy than *S. Careyana;* leaves thicker, more pointed at base, on shorter, stouter and very hairy petioles, the older ones often vinous-red on the under surface; petals strongly bimaculate; filaments clavate, purple with age; capsules less divergent. The character of reflexed or spreading sepals is probably of less importance in distinguishing the two species than has been supposed, but they are abundantly distinct in other respects. (Plate 207.)

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* Ell. Bot. S. C. & Ga. **2**: 615.

EUPHORBIA MERCURIALINA Michx. Fl. Bor. Am. **2**: 212 (1803).

Abundant in the locality where Michaux originally found it, "in collibus circa Knoxville." It grows in rich soil on wooded slopes, and flowers in April and May.

CAREX AUSTRO-CAROLINIANA Bailey, Bull. Torr. Club, **20**: 428 (1893).

This fine *Carex* was discovered by Buckley on Table Mt., S. C., many years ago, and had not since been collected until in April, 1893, I had the good fortune to meet with it in the "gorge" of the Hiwassee River in Polk Co., Tenn. It grows on moist rocks and is a strikingly handsome species. As no specimens bearing mature perigynia have, to my knowledge, been hitherto preserved, a description drawn from good material is here inserted.

Culms numerous, tufted, 25–35 cm. high, slender, compressed, striate; root-leaves bright green, longer or shorter than the culms, flat, channelled, the cauline reduced to sheathing bracts which are erect, spreading or recurved at the apex, with reddish-brown, membranaceous edges; pistillate spikes 1–3, on erect or somewhat recurved, filiform peduncles, the lower sometimes 9 cm. long, 3–6-flowered; scales of pistillate flowers brown, the lower cuspidate, as long as or longer than the perigynia, the upper acute or obtusish, not half as long as the perigynia; perigynium 3–4 mm. long, triangular, somewhat curved, pointed but hardly beaked, about 30-nerved, minutely granulose; achene sharply triangular, filling the perigynium; stigmas 3, conspicuous; staminate spike terminal, slender peduncled, sometimes with a few pistillate flowers at base, 10–15 mm. long, usually more or less curved, scales brown, obtuse.

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* See Mem. Torr. Club, 4: 118 (1894).

The long, filiform peduncles remind one of *C. laxiculmis*, but, as Prof. Bailey has remarked, the colored leafless sheaths and the characters of the staminate spike indicate the affinity to *C. plantaginea*. The perigynia are about two-thirds as large as those of *C. plantaginea*, which they much resemble (Plate 208).

COLLINSONIA VERTICILLATA Baldw.; Ell. Bot. S. C. & Ga. 1: 36 (1816).

Grows in rich soil in a wooded ravine near Knoxville, Tenn. Flowers in May.

STEIRONEMA INTERMEDIUM n. sp.

Perennial; stem erect, 4–8 dm. high, slender, rather obtusely 4-angled, glabrous below, minutely glandular puberulent above as are the petioles, pedicels and calyx; lower leaves 5–7 cm. long, 2–4 cm. broad (the floral much smaller), from broadly ovate below to narrowly ovate-lanceolate above, acute at apex, rounded or more usually truncate, cuneate or subcordate, and unequal at base, margins entire, somewhat sinuate, minutely ciliolate, veins conspicuous but not prominent, sometimes even slightly impressed, often obscurely scurfy-puberulent, leaves otherwise smooth; petioles slender, the lower 3–4 cm. long, ciliate only at the connate base as in *S. radicans;* inflorescence an open leafly panicle, the ultimate divisions corymbose; pedicels slender; 2–6 times as long as the flower; calyx 10–12 mm. in diameter, the segments lanceolate, very acute; corolla bright golden-yellow, 18–20 mm. in diameter, segments cuspidate; capsule about one-third shorter than the calyx lobes.

Virginia: Aikin; Kentucky: Harlan Co., Kearney (No. 121); Tennessee: Knox Co., Kearney; Alabama: Talladega Co., Mohr.

On dry sandstone rocks at an elevation of from 900–1600 ft. Flowers in June and July (Plate 209).

In a genus like *Steironema*, of which the species are strongly confluent, the making of new ones on any but well-marked and constant characters is not advisable. The plant in question is so distinct from any other form known to me, however, that I have no hesitation in giving it specific rank. The fact that it holds its characters over such a wide range is strong evidence of its validity.

The name chosen for the species indicates its intermediate position between *Steironema ciliatum* and *S. radicans.* Apart from the erect habit, the general appearance of the plant suggests more forcibly the latter. It differs from *S. ciliatum* in its more slender habit, leaves shorter and proportionately broader, less conspicuously pointed, petioles ciliate only at the connate base, calyx and corolla smaller. The conspicuously ciliate petiole is a remarkably constant character in *S. ciliatum*. Our plant is distinguished from *S. radicans* by its erect habit, leaves shorter and broader, not pointed at base, and by its much larger and more deeply colored corolla. The habitat is strikingly different from that of either of the two related species. *S. ciliatum* is a plant of low woods and banks of streams, while *S. radicans* grows is grassy swamps and woods along the coast and in the Mississippi Valley.

ANTENNARIA PLANTAGINIFOLIA MONOCEPHALA Torr. & Gray, Fl. N. Am. **2**: 431 (1841–43).

Since reporting this variety from Knoxville, Tennessee, I have collected it in two other localities in the eastern part of that State —near Ducktown, in Polk Co., and near Harriman, in Roane Co. It seems to be a not uncommon plant in the Southern Alleghanies.

RUBUS MILLSPAUGHII Britton, Bull. Torr. Club, **18**: 366 (1891).

Collected at the summit of Thunderhead (about 6,500 feet), and on Chilhowee Mt. (at about 1,500 feet), in Blount Co., Tenn.

ASARUM MACRANTHUM (Shuttl.) Small, Mem. Torr. Club, **5**: 136 (1894).

Collected by Mr. A. Ruth on the banks of the Ocoee in Polk Co., Tenn., in May, 1891, and by me on the banks of the Emory, in Roane Co., in April, 1893.

PLUCHEA PETIOLATA Cass. Dict. Sc. Nat. **42**: 2 (1826).

P. fœtida D.C. Prodr. **5**: 452 (1836), not *P. fœtida* (L.) B. S. P.

This plant is certainly sufficiently well characterized to be maintained as a species distinct from *P. camphorata*. It differs from the common plant of the Atlantic coast in its taller and stouter stem, 1–2 m. high, which is more strongly sulcate, more distinctly angled and less pubescent above; in its thinner and larger leaves 10–18 cm. long, 3–6 cm. wide, which are more pointed at either end, much smoother, of a brighter green color, and taper into conspicuous, slender petioles 20–25 mm. long; in the smaller heads, which are 4–5 mm. high, while those of

P. camphorata are 5–6 mm. high; in the involucral scales, which are merely resinous-granulose and with ciliate margins, while those of *P. camphorata* are densely puberulent all over; and in the shorter pubescence of the much less strongly ribbed achenes.

While *P. camphorata* is a plant of brackish marshes along the Atlantic coast, *P. petiolata* is found in non-saline soil in low ground at roadsides or along streams in the interior. Its range is indicated by the following localities: North Carolina: Rowan Co., Heller; Florida: Chapman; Alabama: Buckley; Tennessee: Buckley; Knox Co., Kearney; Kentucky: Short; Kentucky River: Peter; Harlan Co., Kearney (No. 272, distributed as *P. fœtida*).

Cryptogamic Notes from Long Island.—I.

By S. Ely Jelliffe.

The following list of Musci includes all the mosses that are known to the writer as occurring upon Long Island. It is in no sense a complete list, but is here presented for the sake of comparison and in the hope that it may serve as a stimulus to Long Island collectors. Most of the species recorded are to be found in the "Local Collection" in the Herbarium of the Brooklyn Institute of Arts and Sciences.

SPHAGNA.

Sphagnum cymbifolium Ehrh.
Sphagnum cymbifolium squarrulosum Nees & Hornsch.
Sphagnum acutifolium Ehrh.
Sphagnum subsecundum Nees.
Sphagnum subsecundum obesum (Wils.) Schimp.
Sphagnum cuspidatum Ehrh.
Sphagnum cuspidatum plumosum Nees.
Sphagnum cuspidatum intermedium (Hoffm.) Rau.

MUSCI.

Polytrichum commune L.
Polytrichum Ohioense Ren. & Card.
Polytrichum juniperinum Willd.
Polytrichum tenue Menz. (*Pogonatum brevicaule* Beauv).
Catharinea angustata Brid.

Catharinea undulata (L.) Web. & Mohr.
Catharinea crispa James.
Georgia pellucida (L.) Rab.
Fissidens osmundoides (Sw.) Hedw.
Fissidens taxifolius (L.) Hedw.
Astrophyllum sylvaticum Lindb.
Astrophyllum cuspidatum (L.) Lindb.
Astrophyllum hornum (L.) Lindb.
Astrophyllum punctatum (L.) Lindb.
Sphærocephalus palustris (L.) Lindb.
Sphærocephalus heterostichus (Brid.) E. G. Britton.
Bartramia pomiformis (L.) Hedw.
Bryum cæspiticium L.
Bryum argenteum L.
Bryum proliferum (L.) Sibth.
Bryum intermedium Brid.
Leptobryum pyriforme (L.) Wils.
Funaria hygrometrica (L.) Sibth.
Funaria flavicans Michx.
Physcomitrium turbinatum (Michx.) E. G. Britton.
Barbula unguiculata (Huds.) Hedw.
Barbula curvirostris (Ehrh.) Lindb.
Mollia viridula (L.) Lindb. (*Weisia viridula* Hedw.).
Sphærangium muticum (Schreb.) Schimp.
Pottia truncatula (L.) Lindb.
Leucobryum glaucum (L.) Schimp.
Dicranum flagellare Hedw.
Dicranum scoparium (L.) Hedw.
Dicranum scoparium orthophyllum Brid.
Dicranum interruptum Brid.
Dicranum spurium Hedw.
Dicranum undulatum Ehrh.
Dicranella heteromalla (L.) Schimp.
Dicranella heteromalla orthocarpa (Aust.) C. Müll.
Ditrichum tortile (Schrad.) Hampe.
Ditrichum pallidum (Schreb.) Hampe.
Ceratodon purpureus (L.) Brid.
Ceratodon purpureus aristatus Aust.
Weissia Americana (Beauv.) Lindb. (*Ulota Hutchinsiæ* Sch.).
Weissia ulophylla Ehrh. (*Ulota crispa* Brid.).
Orthotrichum Ohioense citrinum (Aust.) Lesq. & James.
Orthotrichum strangulatum Beauv.
Orthotrichum psilocarpum James.
Drummondia prorepens (Hedw.) E. G. Britton.
Grimmia Pennsylvanica Schwægr.
Grimmia acicularis (L.) C. Muell.
Thuidium recognitum (Hedw.) Lindb.

Thuidium delicatulum (L.) Mitt.
Anomodon rostratus (Hedw.) Sch.
Anomodon attenuatus (Schreb.) Huds.
Amblystegium adnatum Hedw.
Amblystegium serpens (L.) Br. & Sch.
Amblystegium serpens orthocladon (Beauv.) Aust.
Amblystegium varium (Hedw.) Lindb.
Amblystegium riparium (L.) Br. & Sch.
Hypnum lætum Brid.
Hypnum plumosum Huds.
Hypnum rivulare Bruch.
Hypnum Novæ-Angliæ Sull. & Lesq.
Hypnum strigosum Hoffm.
Hypnum Boscii Schwægr.
Hypnum Sullivantii Spruce.
Hypnum demissum Wils.
Hypnum serrulatum Hedw.
Thelia hirtella (Hedw.) Sull.
Thelia asprella (Schimp.) Sull.
Hylocomium parietinum (L.) Lindb.
Hylocomium triquetrum (L.) Br. & Sch.
Stereodon imponens (Hedw.) Brid.
Stereodon pallescens (Hedw.) Lindb.
Stereodon Haldanianum (Grev.) Lindb.
Stereodon pratense (Koch).
Pylaisia velutina Br. & Sch.
Pylaisia subdenticulata Sch.
Plagiothecium denticulatum (L.) Br. & Sch.
Plagiothecium Sullivantiæ Sch.
Cylindrothecium seductrix (Hedw.) Sull.
Climacium Americanum Brid.
Dichelyma capillacea (Dicks.) Br. & Sch.
Fontinalis antipyretica gigantea Sull.
Leucodon julaceus (Hedw.) Sull.
Hedwigia ciliata Ehrh.

A new Selaginella from Mexico.

By Lucien M. Underwood.

Selaginella reflexa n. sp. Stems 2′–3′ long, close creeping, subbipinnate, emitting rootlets along the entire length below; leaves of the lower plane ovate, obtuse, serrate-ciliate throughout and provided with a narrow hyaline border, the upper portion strongly reflexed in drying especially in the lower half of the stem; midrib distinct, vanishing below the apex of the leaf; leaves of the upper plane ovate, abruptly short acuminate, densely serrate-ciliate and provided with a conspicuous white margin, slightly oblique and mostly closely imbricate; spikes scarcely quadrangular, short, lax, with ovate-lanceolate bracts which are ciliate with a narrow pellucid margin.

Damp rocks and banks near Guadalajara, Mexico, 28 Sept. 1889 (C. G. Pringle, No. 2635), also 1893.

Allied to *S. Schiedeana* A. Br., but differs in the conspicuous white margins of the leaves of the upper plane. Four or occasionally three rows of cells enter into this pellucid margin, and as in the above named species each bears a small tubercle. It differs further in the shorter and thicker terminal mucro and in the character and abundance of the tooth-like cilia. In *S. Schiedeana* these are scattered, long and slender, and stand at right angles to the leaf-margin; in *S. reflexa* they are two or three times as numerous and stand like serrations for the most part, each one short and pointing forwards. In *S. reflexa* the fruiting spike is shorter and more lax, and the leaves of the lower plane are strongly recurved, leaving the white-margined upper leaves lying like overlapping scales across the upper surface of the cord-like stem.

Botanical Notes.

Pistillodia of Podophyllum stamen. Among cultivated plants it is not unusual to find instances of stamens taking on the form if not the function of pistils, the most striking examples being perhaps found among the poppies and lilies. With wild plants any such tendency is less frequent and it may be interesting to note that a student, while at class-work examining the flowers of the common mandrake (*Podophyllum peltatum*), called my attention to a peculiar floral structure which proved to be a stamen with the upper portion of the anther bearing a stigma of the corrugate form common to the *Podophyllum* pistil, while below the stamen was of the normal form.

Byron D. Halsted.

Reviews.

Synopsis of Malveæ, or an Enumeration of the Plants contained in the first Tribe of the Natural Order Malvaceæ. Edmund G Baker (8vo, pp. 824; reprinted from the Journal of Botany, 1890-1894).

Mr. Baker has laid the botanical world under deep obligation to him by his publication of the series of papers on Malveæ, now conveniently brought together in one volume. He is modest in terming this work an "enumeration;" it is really much more than this, for diagnoses of all the species of the genera first taken up are given, and we understand from his preface that they would have been given throughout had the space of the Journal been available for the purpose. We presume that the learned editor of the Journal felt that he needed the space which might otherwise have most advantageously been assigned Mr. Baker for the purpose of defending his antiquated views on nomenclature. It is unfortunate that Mr. Baker did not select a more elastic organ for his papers.

The sequence adopted for the genera and the characters relied on for their limitation follow pretty closely the treatment of the group by Bentham and Hooker. *Sidastrum* is a proposed new genus based on *Sida quinquenervia* Duchass. In a supplement Mr. Baker expresses himself as favoring the recognition of Prof. Greene's genus *Hesperalcea*, but he does not agree with Dr. Kuntze in regarding *Malvæopsis* of Presl as an equivalent of *Malvastrum* A. Gray, noting that the type of *Malvæopsis* (*Malva anomala* Link & Otto) is not definitely determined, and is doubtfully referred by him to *Sphæralcea elegans* Don.

A large number of species are described as new, South and Central American ones being added to the genera *Malvastrum, Cristaria, Gaya, Sida, Abutilon* and *Sphæralcea*. A comprehensive index is added. N. L. B.

Description of some fossil plants from the Great Falls coal field of Montana. Wm. M. Fontaine. Proc. U. S. Nat. Mus. **15**: 487-495, *pl. 82-84* (1892).

The following new species and varieties are described: *Aspidium monocarpum, A. angustipinnatum* Font. var. *Montanense, Pe-*

copteris Montanensis, *Cladophlebis heterophylla* and *Zamites Montanensis.* It is unfortunate that the author should have chosen this latter name for a new species, in view of *Zamites Montana* Dawson (on the Mesozoic Floras of the Rocky Mountain Region of Canada, Trans. Roy. Soc. Canada, Sec. iv. (1885) p. 7), which not only resembles it closely in name, but in character and in geological horizon. In fact the absence of all reference to Dawson's work leads us to suspect that the author must have overlooked it, and we are inclined to doubt the validity of this new species, after careful comparison with a large amount of the material from Great Falls. The same may also be said in regard to *Aspidium Montanense*, which is suspiciously similar to *Asplenium Albertum*, Dawson.

A. H.

Proceedings of the Club.

TUESDAY EVENING, MAY 8TH, 1894.

Dr. Britton in the chair and 28 persons present.

The Field Committee reported that all the announced meetings had been held, that the season was very advanced, and the meetings highly appreciated and largely attended.

A communication was read from the Brooklyn Citizens' Committee of the American Association for the Advancement of Science, 43d Meeting, inviting the members of the Club to participate in its hospitalities on the occcasion of that meeting. The communication was accepted and the Secretary instructed to present the thanks of the Club.

A communication was read from Mr. W. T. Bell, announcing the formation of a botanical club with twenty members, in Franklin, Venango county, Pennsylvania.

Dr. Britton then announced the death of Mr. Thomas Morong, on Thursday, April 26, at his son's home in Ashland, Massachusetts, and spoke briefly of his life and work. Upon motion, the following committee was appointed to draw up suitable resolutions concerning the death of Mr. Morong: Hon. Addison Brown, Dr. T. F. Allen, Dr. T. C. Porter.

The following active members were then unanimously elected: Rev. E. C. Bolles, Mr. Wm. D. Young, Dr. Joseph H. Hunt, Mr. A. W. Rand.

Dr. Emily L. Gregory presented some notes upon the subject of the botanical work done at Barnard College.

Mr. Arthur Hollick read his two announced papers: "A New Fossil *Nelumbo* from the Laramie Group of Colorado;" "Additions to the Flora of Richmond County," Contribution No. 7.

WEDNESDAY EVENING, MAY 30, 1894.

The President in the chair and 16 persons present.

The following were elected active members: Miss Marion Satterlee, Mr. L. G. Fay, Miss A. E. Moore, Miss C. Murray, Miss Marie L. Sanial, Mrs. Chas. M. Kirby, Mrs. W. Brookfield, Mr. Joseph Sieke.

The President appointed Dr. S. E. Jelliffe and Mr. T. H. Kearney, Jr., upon the Instruction Committee.

Dr. Britton read a memorial on the life and works of Mr. Morong, which is published in this issue of the BULLETIN.

The announced paper of the evening was then read by Mrs. Britton, entitled "Revision of the Genus *Bruchia*," illustrated by drawings and specimens.

Mr. Pollard reported finding *Ranunculus fascicularis* at Franklin Furnace, Sussex county, New Jersey.

Mr. Van Sickle reported finding *Clintonia borealis* at Stockholm, New Jersey, with a bract on the scape; and also that he had found *Phacelia Purshii* at Granton, New Jersey, on ballast.

The Club then adjourned to meet on the second Tuesday in October.

Index to Recent Literature relating to American Botany.

Allen, T. F. Remarks on *Chara gymnopus* A. Br. with Descriptions of new Species of *Chara* and *Nitella*. Bull. Torr. Bot. Club, **21**: 162–167, *pl. 185–192*. 25 Ap. 1892.

Describes and illustrates *Chara Cubensis* (Cuba), *C. Carmenensis* (L. Cal.), *C. inconstans Hicksiana* (Michigan), *C. depauperata* (Bahamas), *Nitella Mexicana* (Mexico), *N. Californica* (Cal.), *N. occidentalis* (Cal.) and *N. Japonica*.

Arnell, H. W. Moss-studier. Bot. Notis. 1894, 54–63. 1894.

Notes on Species of *Catharinea*, *Pohlia*, *Tortula* and *Amblystegium.*

Atkinson, Geo. F. Steps toward a Revision of the linosporous Species of North American Graminicolous Hypocreaceæ. Bull. Torr. Bot. Club, **21**: 222–225. 25 My. 1894.

Establishes the genera *Dothichloe*, *Echinodothis* and *Myriogenospora* with the new species *D. Aristideæ* and *M. Paspali.*

Baker, J. G. *Tigridia violacea.* Curt. Bot. Mag. **50**: *t. 7356.* 1 My. 1894.

Native of Mexico.

Bay, J. Christian. Material for a Monograph on the Tannoids, with special reference to Vegetable Physiology. Ann. Rep. Missouri Bot. Gard. **5**: 61. 1894. (Reprint issued 18 My. 1893).

Beringer, George M. Notes on the Genus *Myrica.* Am. Journ. Pharm. **66**: 220. My. 1894. Reprint.

Beringer, George M. The Martindale Herbarium. Am. Journ. Pharm. **66**: reprint, pp. 4. My. 1894.

Bessey, C. E. A Synopsis of the larger Groups of the Vegetable Kingdom. Am. Nat. 1 Ja. 1894. Reprint.

Bessey, C. E. Eighth Annual Report of the Botanist of the Nebraska State Board of Agriculture. Ann. Rep. Neb. State Bd. Agric. Reprint, pp. 65–129. 27 My. 1894.

Britton, Elizabeth G. Contributions to American Bryology—VI. Bull. Torr. Bot. Club, **21**: 137–160. 25 Ap. 1894.

Discussion of Western American species of *Orthotrichum* and supplementary Notes on the N. A. species of *Weissia* (*Ulota*).

Britton, Elizabeth G. Contributions to American Bryology—VII. Bull. Torr. Bot. Club, **21**: 189–208, *pl. 197–203.* 25 My. 1894.

A revision of the genus *Physcomitrium*, with descriptions of five new species and with key to N. A. species. Describes and figures *P. pygmæum*, *P. turbinatum* and its var. *Langloisii*, *P. australe*, *P. Kellermani*, *P. Drummondii*, *P. Coloradense* and *P. Californicum.*

Britton, N. L. A new Systematic Botany of North America. Bull. Torr. Bot. Club, **21**: 230, 231. 25 My. 1894.

Britton, N. L. *Cratægus punctata canescens* n. var. Bull. Torr. Bot. Club, **21**: 231, 232. 25 My. 1894.

Chodat, R. Polygalaceæ novæ vel parum cognitæ. Bull. Herb. Boiss. **2**: 167–173. Ma. 1894.

Eight new species of *Monnina* and four of *Bredemeyera* are described with notes on other species, all from South America.

Clarke, Henry L. The meaning of Tree-Life. Am. Nat. **28**: 365. Jn. 1894.

Coste, l'Abbé H., et Sennen. Plantes aventices observées dans la Vallé de l'Orb à Bédarieux et a Hérépian. Bull. Soc Bot. Fr. **41**: 98–113. Fb. 1894.

Lepidium Virginicum, Œnothera biennis, Aster lævigatus, Bidens bipinnata and *Petunia parviflora* are among the North American species adventive in France.

Coville, Frederick V. A Criticism of the "Synonymy of *Juncodes*." Bot. Gaz. **19**: 208. 15 My. 1894.

Davidson, Anstruthers. Californian Field Notes—IV. Erythea, **2**: 83–85. 1 My. 1894.

Notes on northern species near Los Angeles. Describes *Senecio ilicetorum* as new.

De Candolle, C. New Piperaceæ from Bolivia. Bull. Torr. Bot. Club, **21**: 160, 161. 25 Ap. 1894.

Describes *Peperomia pseudo-rufescens, P. psilophylla* and *Piper longestylosum.*

Dewar, D. Perennial Sunflowers. Garden, **55**: 372. 5 My. 1894.

Illustration of *Helianthus lætiflorus.*

Farlow, W. G. Notes for Mushroom-Eaters. Gard. & For. Ja. and Fb. 1894. Reprint, pp. 1–20, *illustrated.*

Glatfelter, N. M. A Study of the Relations of *Salix nigra* and *Salix amygdaloides*, together with the Hybrids arising from them as these Species exhibit themselves in the Vicinity of St. Louis. Trans. Acad. Sci. St. Louis, **6**: 427–431, *pl. 1.* Ap. 1894.

Green, H. A Preliminary List of the Lichens of South Carolina, and some from North Carolina, mostly from Gaston County. Pamph. pp. 4, Chester. 1894.

Two hundred and ten species and varieties are listed.

Green, W. J. Black-Knot, and the Importance of concerted Action against it. Journ. Columbus Hort. Soc. **11**: 12–16. Ap. 1894.

Greene, Edward L. American Species of *Wulfenia*. Erythea, **2**: 80–83. 1 My. 1894.

Unites *Synthyris* with the genus and gives list of eight species.

Greene, Edward L. Observations on the Compositæ—V. Erythea, **2**: 69–76. 1 My. 1894.

Notes on *Pyrrocoma* continued. *Stenotus* and *Macronema* reinstated with lists of species. Discussion of species of *Chrysopsis.*

Grout, A. J. Notes from Vermont. Bot. Gaz. **19**: 200. 15 My. 1894.

Halsted, Byron D. Other poisonous Plants. Bot. Gaz. **19**: 200. 15 My. 1894.

Mentions osage orange (*Maclura aurantiaca*) and star cucumber (*Sicyos angulatus*).

Heim, M. F. L'Ovule de *l'Erythroxylon Coca*. Bull. Mens. Soc. Linn. Paris, No. 142. 7 Fb. 1894.

Hill, E. J. A study of *Quercus Leana*. Bot. Gaz. **19**: 171–177. 15 My. 1894.

Hoffman, Fr. Englisch-sprachliche, pharmaceutische, chemische und botanische Zeitschriften Nord Amerika's. Pham. Runds. **12**: 131–136. Jn. 1894.

Hooker, J. D. *Gynerium saccharoides*. Curt. Bot. Mag. **50**: *t. 7352*. 1 My. 1894.

Hooker, J. D. *Hillia tetrantha*. Curt. Bot. Mag. **50**: *t. 7355*. 1 My. 1894.

Native of Jamaica, Cuba and Mexico.

Hooker, J. D. *Sesbania punicea*. Curt. Bot. Mag. **50**: *t. 7353*. 1 My. 1894.

Native of South Brazil and Argentina.

Kearney, T. H., Jr. The Nomenclature of the Genus *Büttneria* Duham. Bull. Torr. Bot. Club, **21**: 173–175. 25 Ap. 1894.

Kellerman, W. A. Carnation Rust. Journ. Columbus Hort. Soc. **11**: 9, *pl. 1*. Ap. 1894.

Illustration of *Uromyces caryophyllinus*.

Kellicott, D. S. Some Museum and Granary Pests. Journ. Columbus Hort. Soc. **11**: 11. Ap. 1894.

Kronfeld, Mauritius. Typhaceæ. Flora Brasiliensis, **3**: 635–642, *t. 115*. 15 Ap. 1894.

McClatchie, Alfred James. Additions to the Flora of Los Angeles County and Catalina Island—I. Erythea, **2**: 76–80. 1 My. 1894.

List of plants new to the region. Describes three new species of *Ribes* from San Gabriel and San Antonio Mountains.

Meehan, T. *Aconitum uncinatum*. Meehans' Month. **4**: 81, *pl. 6*. Jn. 1894.

Meehan, T. Contributions to the Life-Histories of Plants, No. 10. Proc. Acad. Phila. 1894, 53–59. 1894.

Includes: The Origin of the coreless Apples; The Relations between Insects and the Flowers of *Impatiens fulva*; Apetalism and Seed Propulsion in *Lamium purpureum*; Fruiting of *Robinia hispida*; The Vitality of Seeds—*Antirrhinum glandulosum*; Dimorphic Flowers in Labiatæ—*Dracocephalum natans*; Apetalism in *Sisymbrium Thaliana*.

Meehan, T. Dr. William Baldwin. Meehans' Month. **4**: 95. Jn. 1894.

Olive, Edgar W. Contributions to the Histology of the Pontederiaceæ. Bot. Gaz. **19**: 178–184, *pl. 17.* 15 My. 1894.

Pieters, A. J. The Plants of Lake St. Clair. Bull. Mich. Fish Commission, No. 2, pamph. 3 Ap. 1894.

Plank, E. N. Botanical Notes from Texas—XVIII. Gard. & For. 7: 203. 23 My. 1894.

Pohl, Julius. Botanische Mitteilung über *Hydrastis Canadensis.* Bibliotheca Botanica, Heft 29, 1–12, *pl. 1–4.* 1894.

Pollard, Charles Louis. The Genus *Cassia* in North America. Bull. Torr. Bot. Club, **21**: 208–222. 25 My. 1894.

Describes the North American species and gives key.

Porter, Thos. C. *Scutellaria resinosa* Torr. Bull. Torr. Bot. Club, **21**: 177. 25 Ap. 1894.

Determines identity of *S. resinosa* Torr. and *S. Wrightii* A. Gray, and proposes *S. Brittonii* for *S. resinosa* A. Gray, Synop. Flora, 381.

Robertson, Charles. Flowers and Insects—Rosaceæ and Compositæ. Trans. Acad. Sci. St. Louis, **6**: 435–480. Ap. 1894.

Rose, J. N. A new *Bumelia* from Mexico. Gard. & For. 7: 195. 16 My. 1894.

Description and illustration of *Bumelia Palmeri.*

Sargent, C. S. *Elliottia racemosa.* Gard. & For. 7: 206, *f. 37.* 23 My. 1894.

Sargent, C. S., Editor. Stephen Elliott. Gard. & For. 7: 201, *f. 36.* 23 My. 1894.

Sargent, C. S., Editor. The Sassafras. Gard. & For. 7: 211. 30 My. 1894.

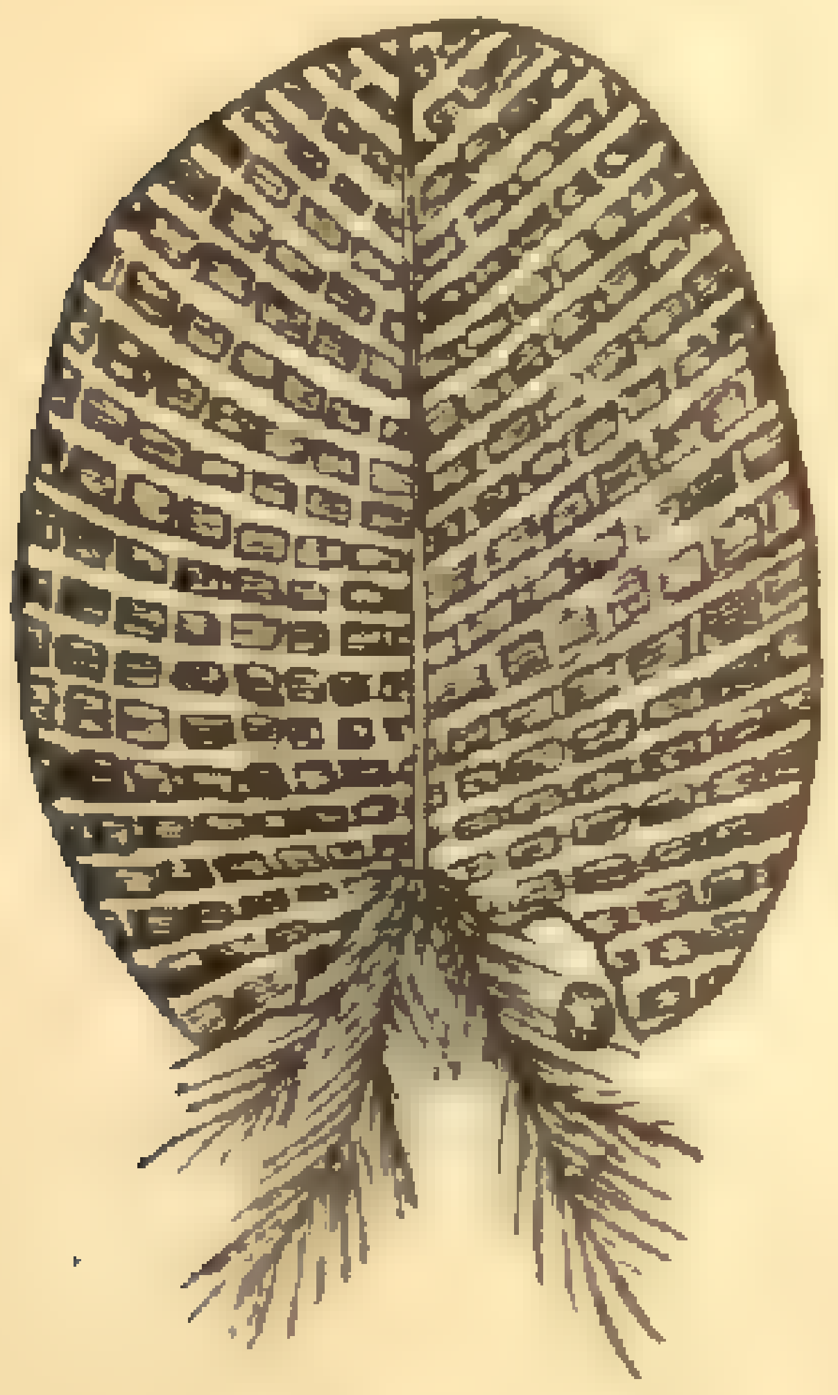
With illustration of an old Sassafras tree on Long Island.

Sauvageau, M. C. Notes biologiques sur les *Potamogeton.* Journ. de Bot. **8**: 1–9; 21–42; 45–58; 98–106; 112–123; 140–148, *figs.* Ja.–Ap. 1894.

Schrenk, Hermann. Teratological Notes. Bull. Torr. Bot. Club, **21**: 226, 227, *pl.* 204. 25 My. 1894.

Notes on seedlings of beans and corn.

Schumann, Carolus. Triuridaceæ, Lileaceæ, Potamogetonaceæ, Zannichelliaceæ, Naiadaceæ, Ceratophyllaceæ, Batidaceæ, Goodenoughiaceæ, Cornaceæ. Flora Brasiliensis, **3**: 643–784, *t. 116–128.* 15 Ap 1894.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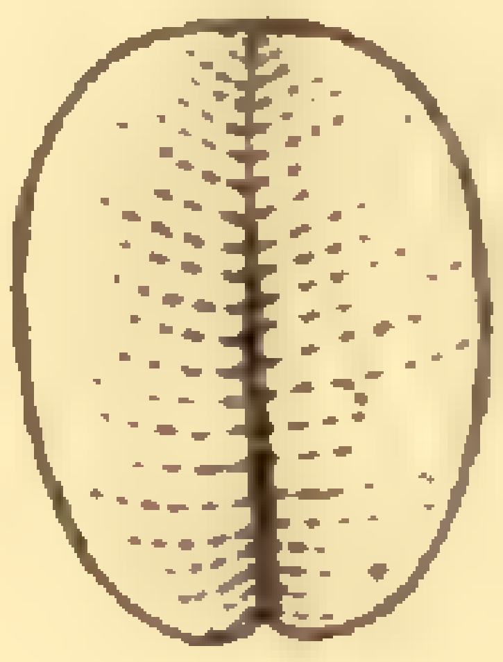
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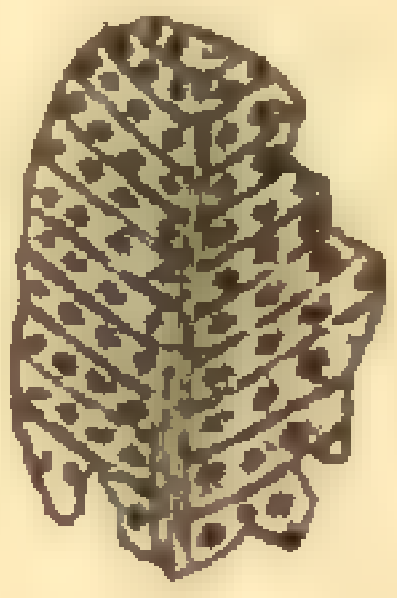
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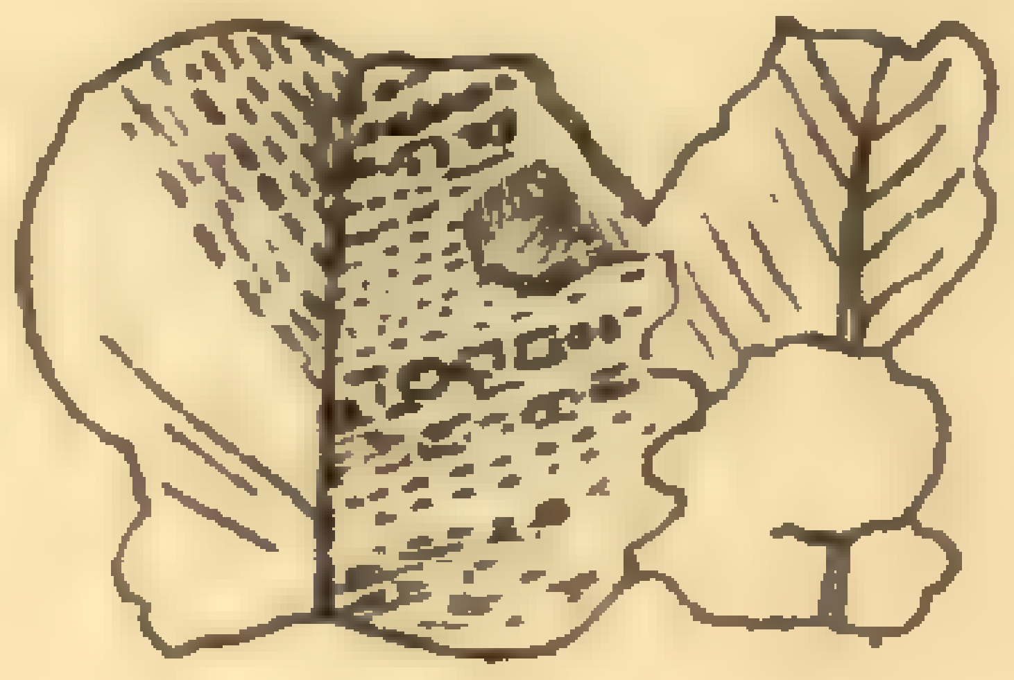
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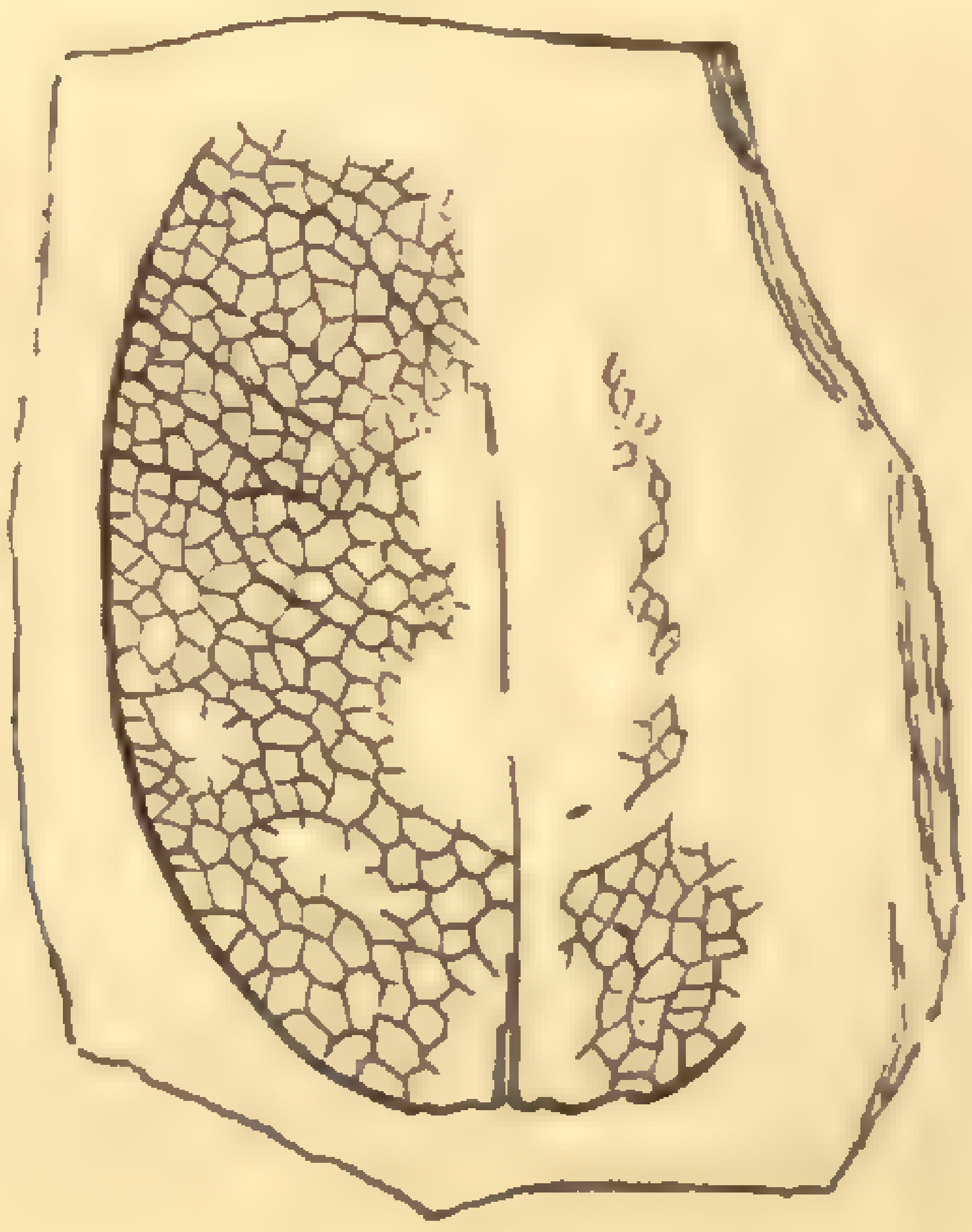
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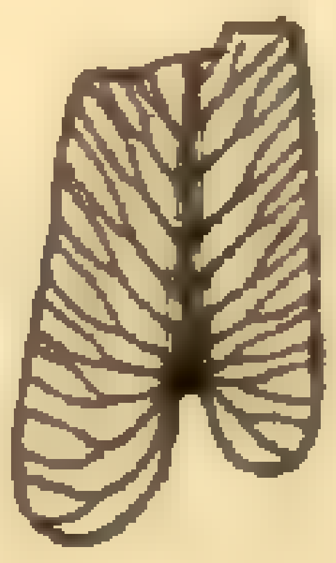
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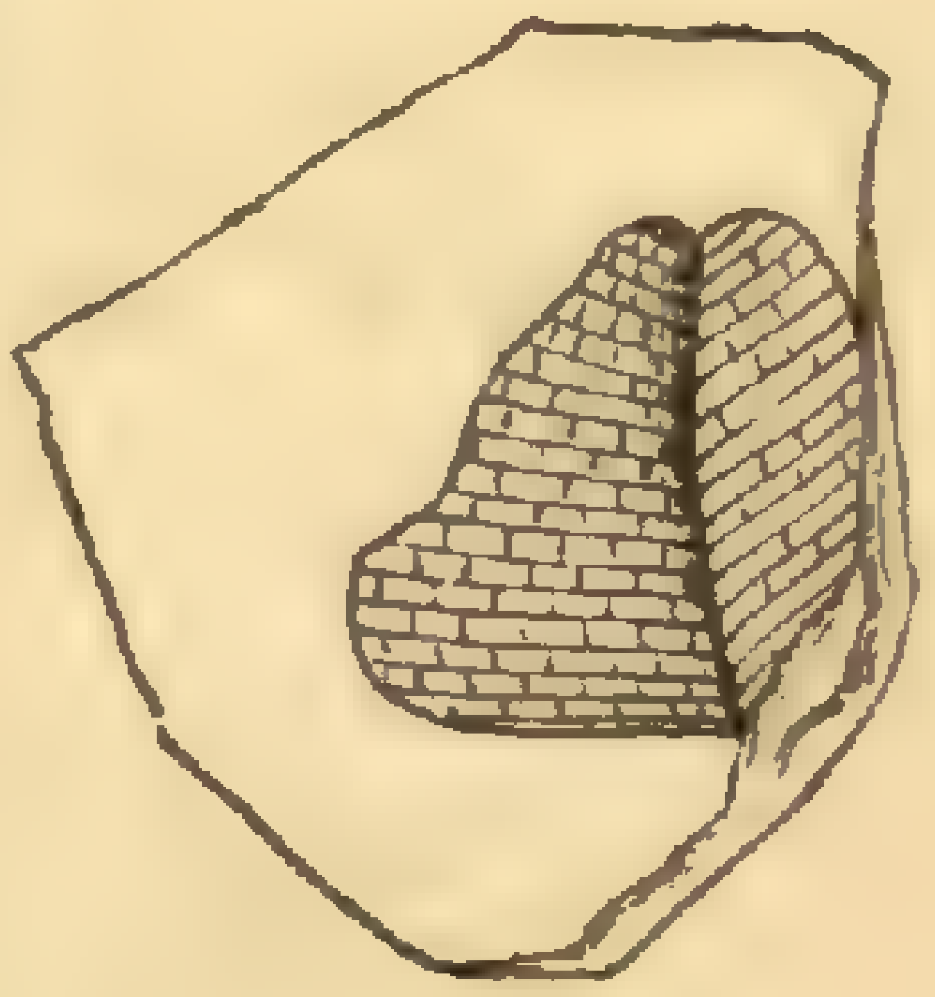
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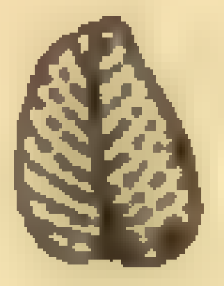
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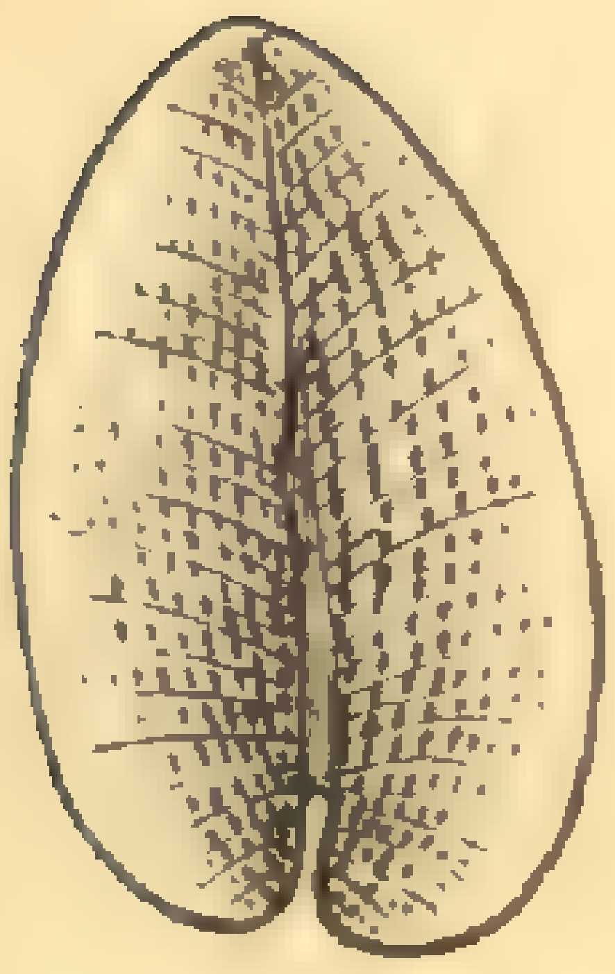
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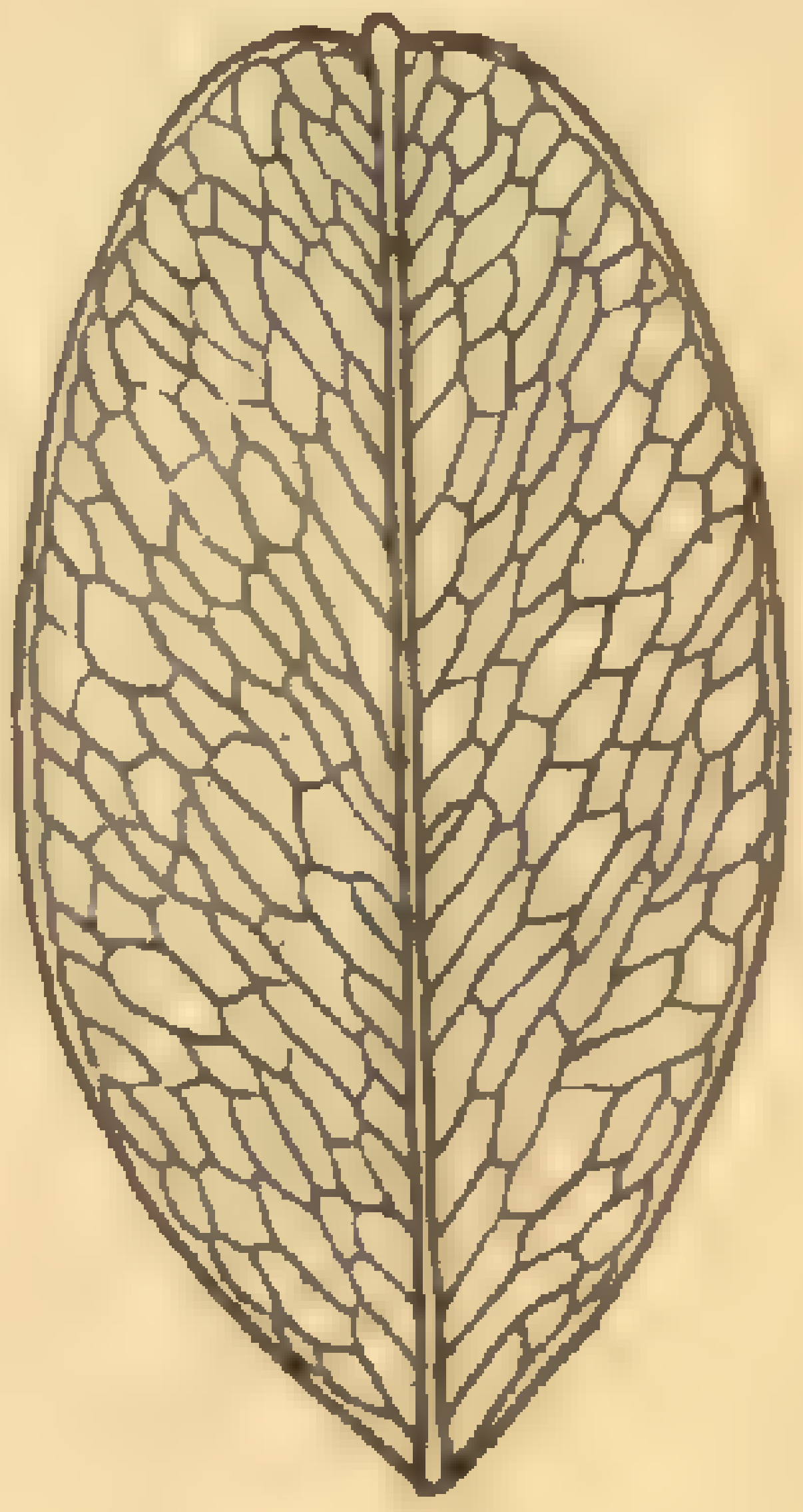
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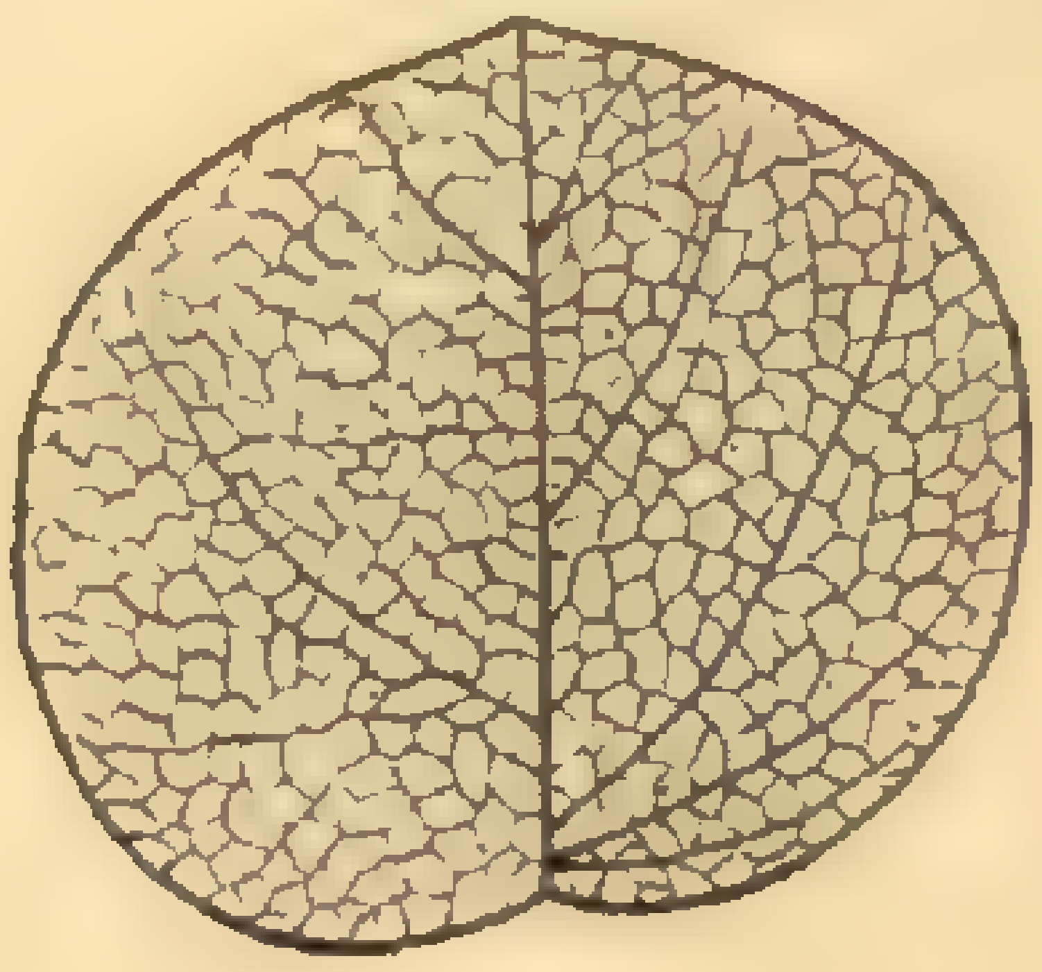
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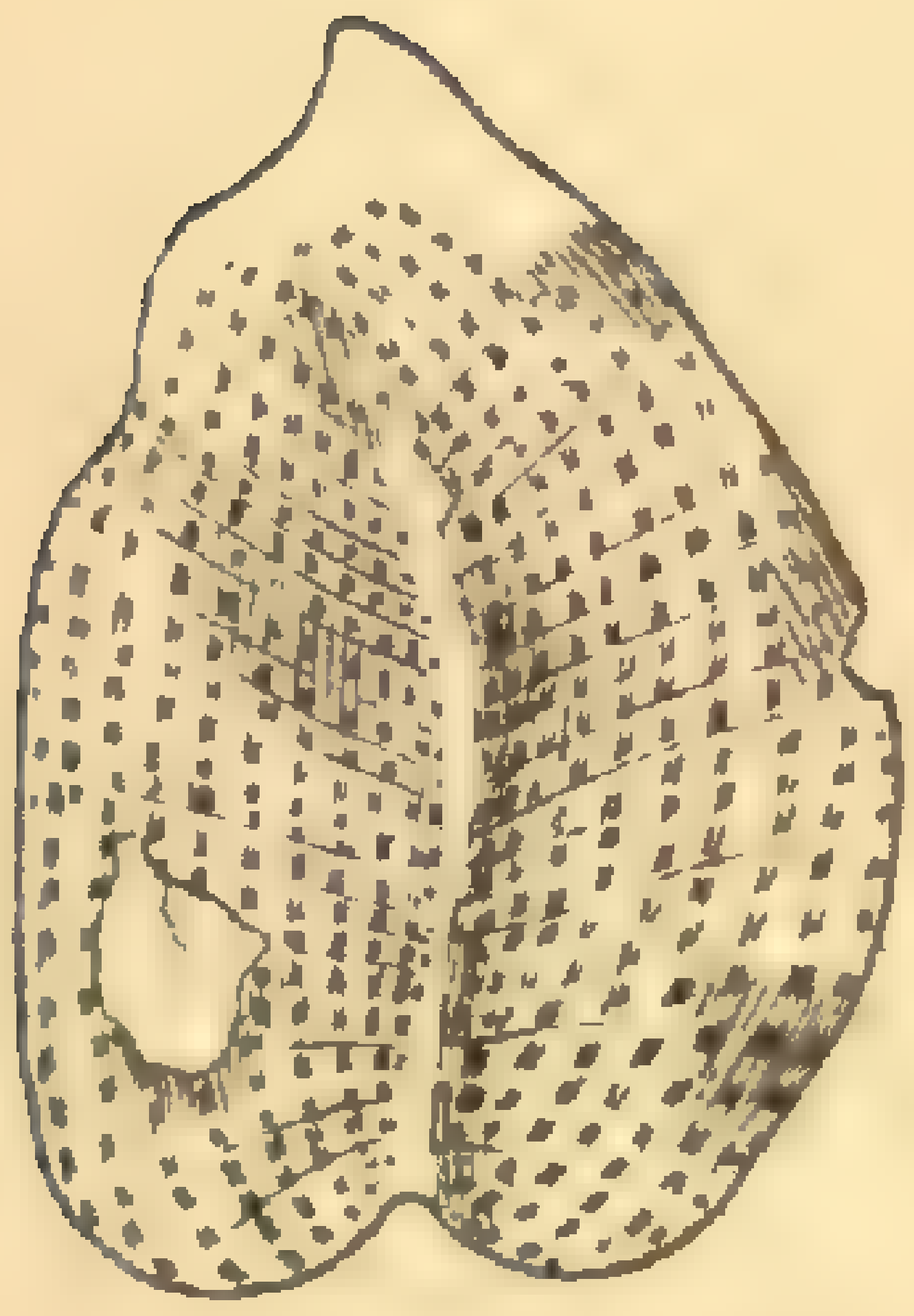
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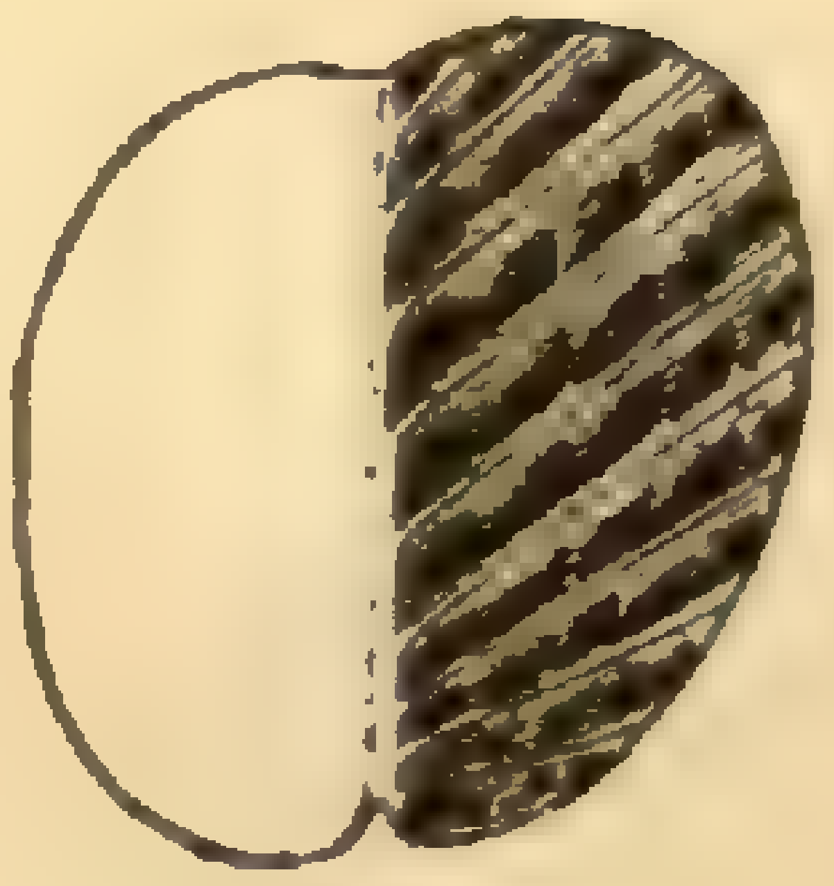
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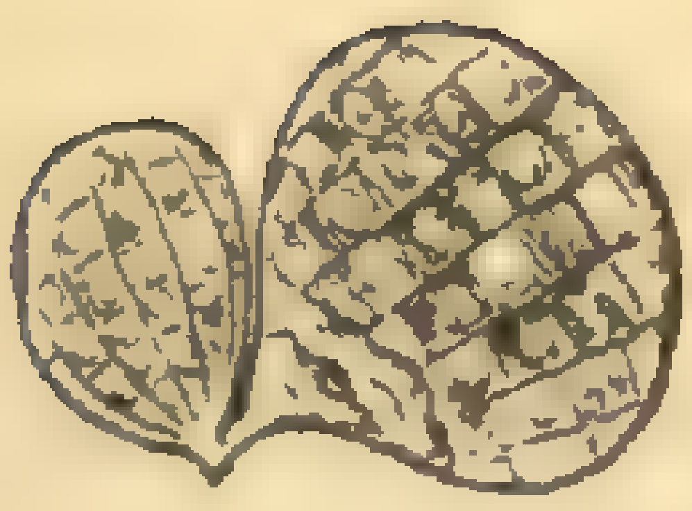
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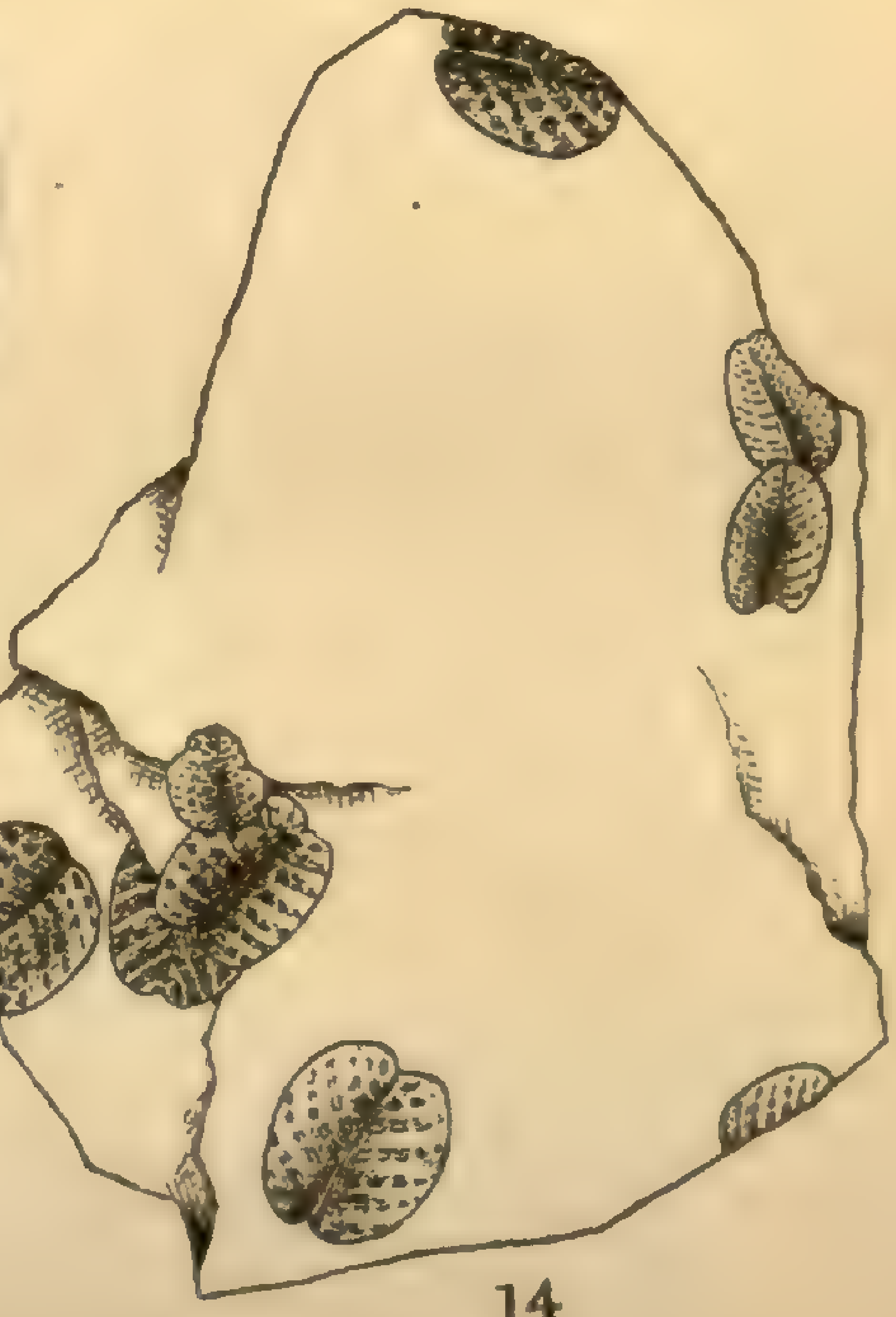
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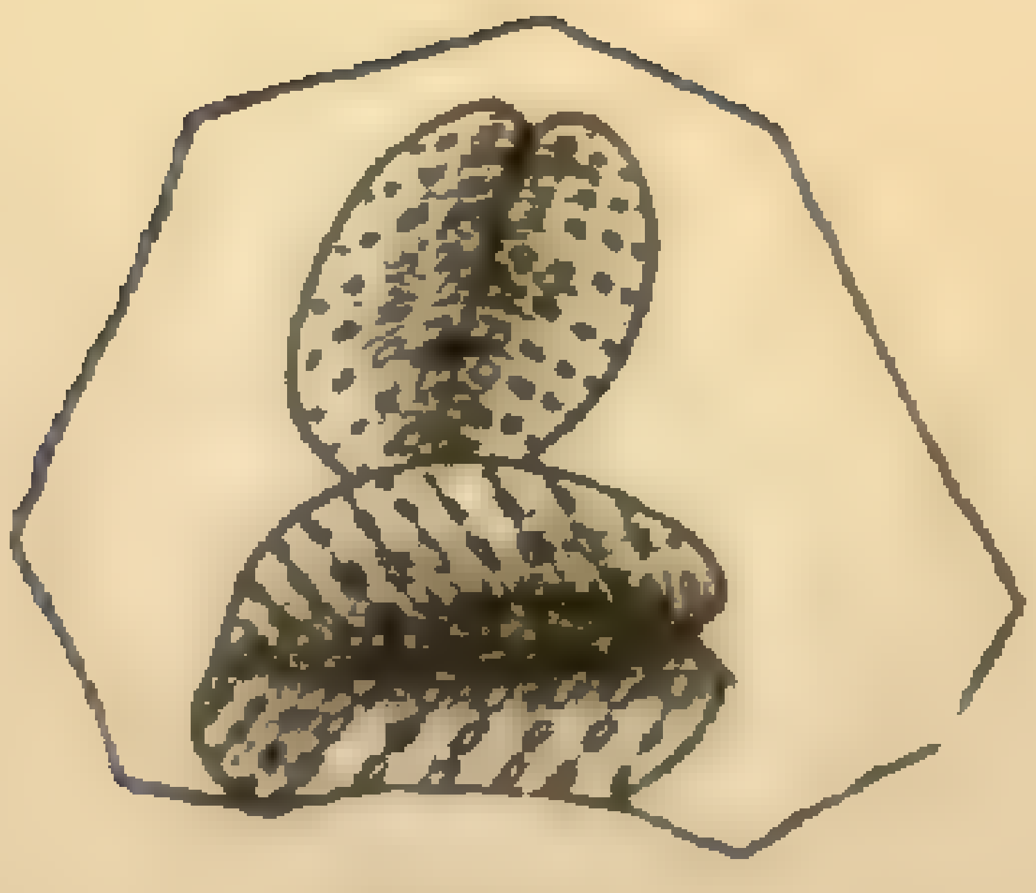
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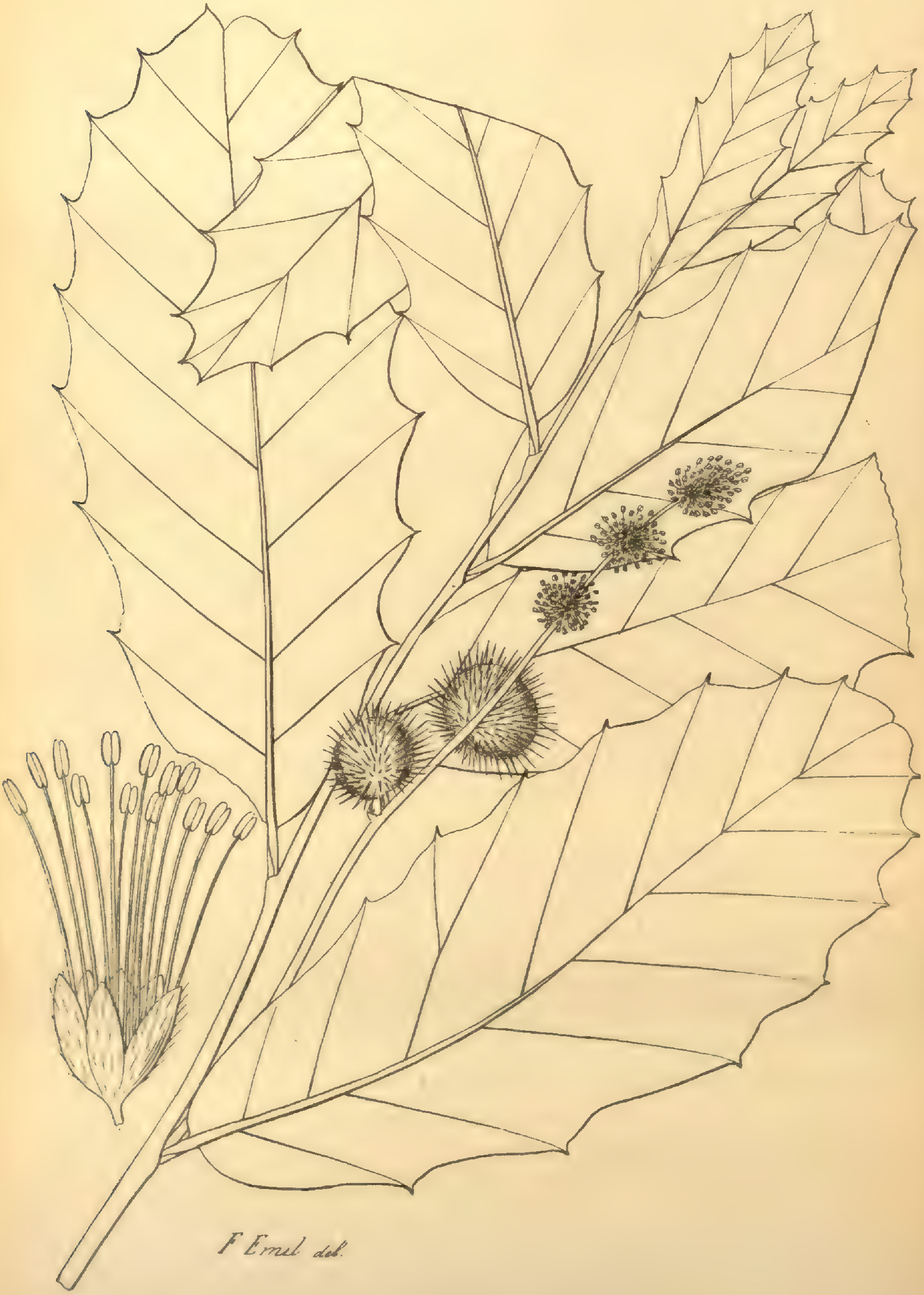

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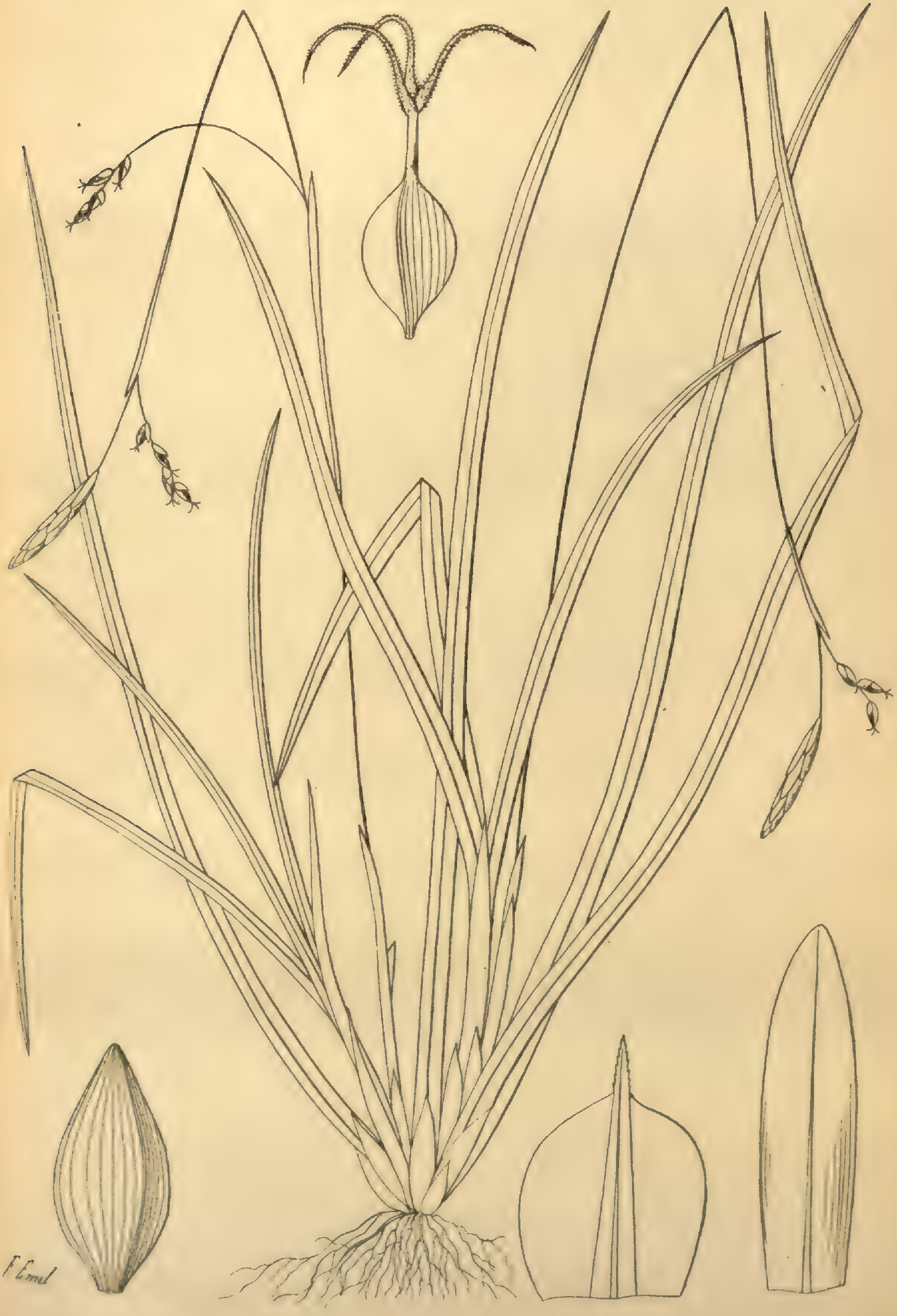

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NATHANIEL LORD BRITTON,

AND OTHER MEMBERS OF THE CLUB.

CONTENTS:

PAGE.
The Comparative Anatomy of *Corema alba* and *Corema Conradii*: *Marion McEwen* (PLATE 210) 277
Some new and rare Desmids of the United States—I.: *L. N. Johnson* (PLATE 211) . 285
Recent Discoveries of Cycadean Trunks in the Potomac Formation of Maryland: *Lester F. Ward* 291
Studies in the Botany of the Southeastern States—II.: *John K. Small* (PLATE 212) 300
A new fossil *Nelumbo* from the Laramie Group at Florence, Colo.: *Arthur Hollick* (illustrated) 307
Varieties of *Solidago* and *Aster*: *Thos. C. Porter* 310
BOTANICAL NOTES.—Peculiar "Range" in an autœcious Uromyces (illustrated): *Byron D. Halsted*; *Sherardia arvensis* in New Jersey: *Chas. D. Lippincott*; Note on *Cassia armata*: *C. L. Pollard*; A Request: *A. A. Heller*; Note on the Genus *Enslenia*: *N. L. Britton* 311
INDEX TO RECENT LITERATURE RELATING TO AMERICAN BOTANY 314

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BULLETIN

OF THE

TORREY BOTANICAL CLUB.

Vol. 21. Lancaster, Pa., July 20, 1894. No. 7.

The Comparative Anatomy of Corema alba and Corema Conradii.*

BY MARION C. MCEWEN.

(PLATE 210.)

The Order Empetraceæ includes but five species, all small evergreen plants with diœcious inconspicuous flowers and drupaceous fruit. They closely resemble one another and all have the general appearance of certain Ericaceæ. Of the genera now included in the Empetraceæ, Jussieu knew but one, and its resemblance to the Ericaceæ was so marked that he referred it to that order. Nuttall, on the contrary, in his description of the Empetraceæ, in 1818, considered them closely allied to the Coniferæ, while Don believed them to hold an intermediate position between Euphorbiaceæ and Celastraceæ. Dr. Gray, in the earlier editions of his Manual, placed the order between Euphorbiaceæ and Urticaceæ, while in the later editions it is put between Salicaceæ, with which it has little or no morphological connection and Ceratophyllaceæ.

In his description of the order, Dr. Gray indicates the questionable position of Empetraceæ by saying that it "has the foliage, aspect and compound pollen of heaths, the drupaceous fruit of *Arctostaphylos*, but the divided or laciniate stigmas, etc,, of certain Euphorbiaceæ, and that it is "probably only an apetalous and polygamous or diœcious degenerate form of Ericaceæ."

---

* Investigation conducted at the Botanical Laboratory of Barnard College.

Within the family the question of generic relationship has been the subject of discussion. Their close resemblance in morphological characteristics evidently entitles the five species to be classed in the same natural order, but under how many or what genera is not so clear.

There are three genera now recognized in the order, namely, *Empetrum*, *Ceratiola* and *Corema*. In the genus *Empetrum* are two species, *nigrum* aud *rubrum*, the former being circumboreal and widely distributed in high altitudes, while the latter is found in Southern South America. There is one species of *Ceratiola*, *C. ericoides*, which is found in the southern United States.

The genus *Corema* was named by Don after a careful study of the then so-called third species of *Empetrum*, *E. album*. This plant, which was discovered in Portugal, and as yet has been found only there and in the Azores, was from its general appearance and habit at first referred to *Empetrum*. Later Don found morphological differences in the new species, notably in the number of cells of the ovary, the kind of inflorescence and the lack of any proper perianth, which he considered sufficient to constitute a new genus. This he called *Corema*, giving us the third genus of the Order Empetraceæ with the one species *C. alba*.

Until 1837 these four species, under three genera, were the only representatives of this order known, the genus *Corema* not being known to occur in this country.

About that date Dr. Conrad found near Pemberton Mills, New Jersey, a small evergreen plant which he failed to identify. Specimens coming into the posession of Dr. Torrey he referred it to the order Empetraceæ, placing it in the genus *Empetrum*, noting at the same time its agreement in some particulars with *C. alba*. Dr. Torrey named the new species, in honor of Dr. Conrad, *E. Conradii* (Ann. Lyc. N. Y., **4**: 83. 1837).

A little later Tuckerman sent very complete specimens of the new species to Dr. Klotsch in Berlin, who decided that it did not properly belong to any of the three genera of Empetraceæ, but constituted a new genus of the same order. Accordingly, he published a detailed description of the new genus, calling it *Tuckermania*, in honor of Dr. Tuckerman (*T. Conradii* Klotsch, Wiegm. Arch. 7: 248. 1842). But as this generic name had already been used by Nuttall, Tuckerman, in the same year, changed it to *Oakesia*, in honor of Dr. Oakes (*O. Conradii* Tuckerm., Hooker's Lond. Journ. Bot. 1842).

In the meantime Dr. Torrey and Dr. Gray had critically studied the plant in this country from fresh specimens, and they both became convinced that the new species agreed in all important characteristics with *Corema alba*, and accordingly in 1842 Dr. Torrey changed the name to *C. Conradii* (*C. Conradii* Torr.; Loud. Arb. Brit. 1092. 1842), and it has since remained under that genus.

We have, therefore, in the genus *Corema* two species; the one, *alba*, confined to Portugal and Azores; the other, *Conradii*, found only along the eastern coast of the United States, in widely separated localities, from Newfoundland to New Jersey.

Accepting the evolutionary idea of the origin of species, a puzzling question arises as to the genetic relationship between these two species, their geographical distribution being difficult to reconcile with the idea of a common origin.

The morphology of the two has already been carefully studied and described; their comparative anatomy, however, has not been considered. In view of the importance now given to anatomical characteristics in plant classification, the comparative anatomy of these two plants has been an interesting study, and it is the purpose of this paper to give some of the results of such a study.

It has been impossible with the material available to follow the development-history of the tissues from their origin in the embryo, and the anatomy of the root has not been attempted, but a comparative study of the tissues of the fully developed stem and leaf has revealed some points of resemblance and difference from which conclusions may be drawn as to relationship.

The thick, deeply-grooved, evergreen leaf of *C. alba*—the type of the genus—is about 1 mm. broad, and, including the short petiole, 7 mm. long. It somewhat resembles the small leaves of some Coniferæ. A cross-section of the mature leaf (Fig. III.), under the microscope, shows the morphology to be strikingly different from that indicated by the outward appearance. Instead of a solid mass of tissue, as it seems to the naked eye, we find a flat leaf with its blades rolled under and the edges turned in so that only the upper surface of the leaf is visible from without, the lower surface lining the cavity thus formed. The groove on the under surface of the leaf is the narrow slit-like opening left between the rolled-under blades through which the lower surface of the leaf has direct communication with the air. The anatomy is in general that of the typical dicotyledonous leaf, but with some peculiarities to be described in detail.

Beginning with the upper epidermis (Fig. V.), the enormous size of its cells and the extreme thickness of the outer wall are first noticed. By actual measurement this outer epidermal wall, in some instances, equals one-fifth of the entire distance from the upper to the under surface of the leaf. The epidermal cells are further distinguished (Fig. V.) by a thickening of the walls which projects into and partially fills the lumen. These projections are sometimes in the form of irregular masses, but oftener the walls are thickened regularly, some time nearly filling the lumen. In all cases these thickenings, together with all the walls of the epidermal cells, except the sharply defined outer layer of the upper wall, respond to the tests for cellulose. The outer layer shows a cutin reaction. The mesophyll tissue consists of two layers of palisade cells and spongy tissue below of irregular branching parenchymatic cells with very large intercellular spaces. The lower epidermis, unlike the upper, consists of cells of ordinary size, and these are interrupted by numerous raised stomata. The entire lower surface of the leaf is thickly covered with hairs of two kinds—long, one-celled, thick-walled hairs, and three-five-celled capitate glands. The simple hairs predominate. The vascular system is simple, the shape of the leaf being such as to require but little supporting tissue. At regular intervals lateral bundles branch from the stout midrib, and there is a mere trace of bundles forming the net-veining of the dicotyledonous type. An entire absence of bast cells is a peculiarity of these bundles, a circumstance not remarkable in a leaf which needs so little strengthening element. An endodermis of somewhat thick-walled cells encloses the whole vascular system, separating the bundles from the surrounding tissues.

The leaf of *C. Conradii* is smaller and is minutely denticulate on the apparent margins, but otherwise it has the same outward appearance as the *alba* leaf, that of a thickened evergreen leaf deeply grooved on the lower surface. A cross-section, however (Fig. IV.), shows its morphology to be very different from that of *alba*. The leaf of *alba* is flat, with its blades rolled in such a way as to simulate a thickened leaf; that of *Conradii* is really thickened. That is, the central portion of the leaf is thickened and the edges of the blade are abruptly turned under, their margins nearly meeting below the lower surface, forming a furrow and leaving a small triangular cavity along the lower surface. As in *alba*, only the upper surface of the leaf is visible from without, the lower surface lining the cavity.

Comparing now the anatomy (Fig. VI.) with that of *C. alba*, we find the cells of the upper epidermis unusually large and with the outer wall thickened, though usually not so much as in *alba*. These cells agree with the epidermal cells of *alba* in having the cellulose thickenings in the lumen. These growths occur in the remarkably large lumen of cells which have to sustain the weight of a heavily thickened cuticle. For this reason it would seem that their function is that of mechanical support, performing the same office that similar growths do in the lumen of some large tracheæ and other thin-walled cells which have to sustain the pressure of heavier tissues. In certain families, notably the Urticaceæ, there is often a deposit on the inner surface of the wall of the epidermal cells in the form of cystoliths. The growths found in the cells under discussion, however, show none of the chemical reactions of cystolith formations, but in both species seem to be pure cellulose. The mesophyll tissue is like that found in *alba*, its development corresponding to the morphology of the thickened *Conradii* leaf. The same simple vascular system occurs; the bundles have no bast element, and the whole is enclosed by the endodermis sheath.

Coming to the lower epidermis, with its accompanying stomata and hairs, some differences are seen, although there are the same epidermal cells of ordinary size, the distinctly raised stomata, and the two forms of hairs—the long, one-celled hairs and the three-five-celled capitate glands that are found in the *alba* leaf.

The first difference noticed is the position of the simple hairs. Instead of being mingled with the glands over the whole lower surface of the leaf, they occur here only along the very edges of the incurved margins. These long hairs project from either margin in such a way as to interlace along the whole length of the groove on the lower surface of the leaf. There is also a great increase in the number of the raised stomata.

For the anatomy of the stem, sections were made in both species from shoots of one year's growth. Again, beginning with a description of *alba*, a cross-section shows, in general, the structure common to woody dicotyledonous stems of that age. Both species are alike in that there is no periderm formation the first year, but the epidermis remains until the formation of the second year's wood. This is somewhat unusual, because in stems where a periderm is formed it is likely to appear very early in the first season.

The epidermis, in the *alba* stem, consists of cells of ordinary size with the outer wall thickened and cutinized and the thickening extending into the radial walls. Next to the epidermis is the zone of cortical parenchyma, which varies in depth from two to several layers of large cells. Separating the cortical tissue from the central cylinder is a distinct layer of cells one layer in width. These cells have a longitudinal diameter about four times that of the radial and tangential, and their outer tangential walls are much thickened. Their walls also respond to the test for suberin, and they correspond to the endodermis sheath which DeBary describes as occurring in the stems of some woody dicotyledons. The phloem zone is narrow and, like the phloem of the leaf bundle, is peculiar in having no bast elements. The cambium zone is about two rows of cells in depth. The libriform cells have bordered pores in abundance on both their tangential and radial walls, but no simple pores. The ducts are numerous but not of unusual diameter for wood of this character, and they too have bordered pores and a few have spiral markings. Towards the pith are crowded the narrow tracheids which show both ring and spiral sculpturing. The medullary rays are one cell in width, and the pith cells are of the ordinary type.

Sections of the *Conradii* stem show a structure similar to that of *alba*. Its deviations from the typical dicotyledonous woody stem, like those of *C. alba*, are an endodermis sheath, an entire absence of bast tissue, and the presence of only bordered pores in the libriform cells. This occurrence of only bordered pores in the libriform has been found by Dr. Gregory to be a characteristic common to the orders Empetraceæ and Ericaceæ—a fact which may bear upon the question of relationship between them.

This examination of the anatomy of the stem and leaf of the two species brings us to the question, What does it indicate regarding the relationship between *Corema Conradii* and *Corema alba?* Considering only the anatomy of the two stems, it leads decidedly to the opinion that they are species of the same genus. This relationship is not so strongly indicated, however, by the character of the leaves.

Taking *alba* as the type of the genus, the variations from the type shown in the *Conradii* leaf would indicate an adaptation of that plant to a changed environment rather than an original generic difference. This plant, *C. Conradii*, has apparently adapted itself to a climate subject to drought and extremes of heat and cold. This is first shown by the thickening of the leaf, whereby the working tissues are more compactly arranged and a smaller surface is exposed. To provide against long continued drought, there is an arrangement similar to that found on leaves which are known to need protection from excessive evaporation. The long hairs before referred to, which are found only on the very edges of the *Conradii* leaf, interlace, forming a felt-like mass, with only capillary spaces through which the lower surface of the leaf has communication with the air. This regulates the amount of evaporation from the stomata by retarding the escape of moisture from the channel inside, while at the same time, by retaining the heat given off, it protects it against the cold.

On the other hand, this arrangement of hairs, which prevents evaporation and raises the temperature of the leaf, hinders the free interchange of gases. This, again, is remedied by the raised stomata. If the stomata were sunken, or even level with the epidermis, it would be difficult to effect the proper circulation inside the tissues. Hence the development of the raised stomata, which, by their form, allow a freer passage of air in and out. Furthermore, there is a great increase in the number of stomata over those on the *alba* leaf.

The leaf of *C. alba*, though similar in many respects, does not show the same adaptation to extremes of climate. It is more nearly flat, thus exposing a larger surface. The rolling under of the blade and the growth of hairs on the lower surface form a protected cavity which, in a measure, regulates the amount of evaporation through the stomata, but still the air has free access to the whole surface. Here again are the raised stomata, but much fewer in number. In one respect, however, this leaf is better prepared for extremes of temperature, namely, the enormous thickness of the cutinized outer wall of the upper epidermis, which even exceeds that of *Conradii* in most instances.

The leaf is the first organ where we should expect to find changes for the accommodation of the plant to a changed environment. It is primarily the organ for the individual uses of the plant, for through it is obtained food material from the air, and in it the chief processes of metabolism are supposed to take place. Again, it is the metamorphosed leaf which is used for the reproductive processes of the plant. Here the leaf gives up its function as the servant of the individual and its energy is turned to the perpetuation of the species. In the whole life history of a plant species the leaf is the inconstant organ, changing its form and function for the varying needs of the individual and the species. The stem, on the contrary, is the constant organ. It is, therefore, to the anatomy of the stem, rather than that of the leaf, that botanists attach the first importance in the determination of relationship. In the same genus only the slightest variations are expected in the anatomy of the stems of the different species.

In the two species under discussion the stem of *Conradii* agrees with that of *C. alba* in all particulars, showing the same deviations from the normal dicotyledonous type. The leaf of *Conradii* has all the peculiarties of *alba* shown in the raised stomata, the two sorts of hairs, the extremely thick cuticle, and the unusually large epidermal cells with the strengthening projections of the cellulose wall. It disagrees in ways which indicate adaptation to environment rather than difference in origin.

Therefore, the result of the comparative study of the tissues favors the classification already made of these two species.

In view of the resemblance between the orders, a comparison of the anatomy of the species of Empetraceæ with the typical Ericaceæ would be an interesting study, and this we hope to accomplish.

Explanation of Plate 210.

FIG. I. Leaf of *C. alba*, lower surface. a. Groove.

FIG. II. Leaf of *C. Conradii*, lower surface. a. Groove.

FIG. III. Outline of cross-section of leaf of *C. alba*.

FIG. IV. Outline of cross-section of leaf of *C. Conradii*.

FIG. V. Portion of a cross-section of a mature leaf of *C. alba*. a. Thickened cuticle. b. Lumen of the large epidermal cells. c. Thickenings of the cellulose wall of epidermal cells. e. Raised stomata on lower surface. f. Simple hairs. g. Glands.

FIG. VI. Portion of cross-section of a mature leaf of *C. Conradii*. a. Thickened cuticle. b, b. Lumen of epidermal cells. c, c. Thickenings of cellulose wall of epidermal cells. d. Midrib. e. Raised stomata. f. Simple hairs. g. Capitate glands.

FIG. VII. Cross-section of stem of *C. alba* one year old. a. Epidermis. b. Rind parenchyma. c. Endodermis.

Some New and Rare Desmids of the United States.—I.

BY L. N. JOHNSON.

(PLATE 211.)

During the last two or three years the writer has examined quantities of material rich in Desmids from various parts of the country. Among the species noted are some rarities, while a few are apparently unrecorded from the United States, and several are undescribed. It is not my purpose here to give complete lists of all species found, but merely to mention some of the most interesting "finds." The Connecticut specimens mentioned, unless otherwise stated below, were collected at Bridgeport, those from New York at Cold Spring Harbor and the Michigan material at New Baltimore. Curiously enough in these gatherings some of the species recorded by Wolle as common have proved very rare, or have not been seen at all. For example, *Tetmemorus Brebissonii* (Menegh.) Ralfs. has been found but once, and then but a single specimen at Waverly, Mass. On the other hand, some so-called rare species have proved rather abundant, at least in certain localities.

Of the filamentous forms the most interesting were *Onychonema filiforme* (Ehrenb.) Roy and Bissett, and *O. leve* Nordst. at Bridgeport, and *O. leve,* var. *micracanthum* Nordst. from Michigan. The spines of the last named were often not so large as shown in the drawing (Fig. 15). *Hyalotheca undulata* Nordst. was found (Conn.) having a diameter of about 7 μ and with the sheath inconspicuous if present. It thus resembles the type more closely than Wolle's description.

Sphærozosma pulchellum (Arch.) Rab. is frequent in Connecticut, as is another species, undoubtedly *S. Wallichii* Jacobsen. It agrees well with Wallich's description and figures * of *S. excavatum* var. β. It was very abundant last season in the locality mentioned, and across the Sound in New York, and was also found in Michigan. Dimensions, length 12–14 μ, diameter 10–12 μ.

Spirotænia obscura Ralfs. was found near Oyster Bay, N. Y., in 1893. The specimens were in fine condition, and averaged 25 μ in diameter, thus being of about the same size as European specimens. Wolle gives the diameter 8–15 μ.

Of *Closterium* the most noteworthy species collected are *Cl. lineatum* Ehrb. var. *costatum* Wolle (Conn.), *Cl. didymotocum* Corda (Conn.), and *Cl. malinvernianum* DeNot (Mich.). The second agrees perfectly with descriptions and figures of the species named, but the diameter of the cells is 45–52 μ Delponte figures it from Italy of similar form and size. The last may be *Cl. Ehrenbergii* Menegh. var. *brasiliense* Nordst., for there seems little difference between the two forms. The membrane is finely striate, diameter of cell 92 μ, and length eight times as great. It has not before been reported from the United States.

My specimens of *Euastrum gemmatum* Breb., do not resemble Wolle's figures very closely, but are much like those of Ralfs. It is common in Connecticut material.

Euastrum binale Ralfs. var. *insulare* Wittr., of the form shown in Fig. 8, is quite common in Michigan and Connecticut material.

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* Annals and Mag. of Nat. Hist., Ser. 3, **5**: 192, *pl. VII., fig. 15* (1860).

E. pinnatum Ralfs, I have from Florida, Connecticut and New York.

At Cold Spring Harbor, N. Y., a number of species of *Micrasterias* were abundant last summer, the most noteworthy being *M. foliacea* Bail. (sometimes in filaments of a hundred cells), *M. papillifera* Breb., and *M. muricata* (Bailey) Ralfs. *M. furcata* Ag. was also common and extremely variable, as shown elsewhere.*

Of *Cosmarium* many interesting forms have been found. The following deserve mention:

C. anisochondrum Nordst. (Mich.).

C. Boeckii Wittr. (Conn.).

C. calcareum Wittr. (Mich.), Fig. 13. This agrees well with Wittrock's description and figures,† except that the larger granules, nine or ten in number, are often arranged in an ellipse with two partly fused ones in the center. Dimensions: length 18–20 μ; diameter 18 μ.

C. cyclicum Lund. (Ann Arbor, Mich.), Fig. 5.

C. impressulum Elfv. (Mich.), Fig. 6. This has probably been passed over as one of the forms of *C. Meneghinii* Breb. It is quite common.

C. monomazum Lund. var. *polymazum* Nordst. (Edgemoor, Ind.).

C. protractum Arch. (Evanston, Ill., and Waverly, Mass.).

C. Quasillus Lund. (Ann Arbor and Northfield, Mich.).

C. subglobosum Nordst. (N. Y.), Fig. 7. This agrees well with Nordstedt's figures and description,‡ except in the relatively short cells. The dimensions given in the original description were, length 37–48 μ, diameter 24–40 μ, while in these specimens they are, length 33–36 μ, diameter 26–28 μ.

C. subspeciosum Nordst. (Mich).

C. sulcatum Nordst. (Mich. and Conn.), Fig. 11. The specimens were quite abundant and were typical. Dimensions: length, 38 μ; diam., 30 μ; isth., 8 μ.

C. suprospeciosum Wolle (Ann Arbor. Mich).

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* Botanical Gazette, 19: 56, *pl. 6* (Feb., 1894).

† Om Gotlands och Ölands Sötvattens-alger, 58, *pl. 4, fig. 13* (1872).

‡ De algis aquae dulcis et de characeis ex insulis Sandvicensibus a Sv. Berggren, 1875, reportatis, p. 14, *pl. 1, fig. 13* (1878).

C. tenue Arch. (common almost everywhere). Often found in quantity and usually with zygospores. I believe it is the form described and figured by Wolle as *C. bioculatum* Breb. It cannot be that species, for it has smooth zygospores (see Wolle's figure, Desmids of the U. S., Pl. XVIII., Fig. 22).

C. triplicatum Wolle (Conn. and Ann Arbor, Mich).

C. tessellatum (Delp.) Nordst. (Ann Arbor, Mich.), Fig. 17. This is one of the most interesting species found. Only a single specimen was found, but that was in fine condition and agreed exactly with Delponte's figures and measurements. This specimen measured 68 x 140 μ. It has not before been found here.

In addition to this species the following are new to the United States.

C. calcareum Wittr., *C. cyclicum* Lund., *C. subglobosum*, Nordst.

C. subspeciosum Nordst., *C. sulcatum* Nordst. It is interesting to note that of the new species described by Nordstedt from the Sandwich Islands, three have now been found in this country. They are *C. anisochondrum*, *C. sulglobosum* and *C. sulcatum*.

Staurastrum aspinosum Wolle was found abundantly in Connecticut and New York. Other interesting species are:

St. megacanthum Lund. (Conn.). Quite rare.

St. cuspidatum Breb. (Conn.). Only occasionally seen.

St. Hystrix Ralfs. (N. Y.). Scarce.

St. incisum Wolle (Edgemoor, Ind., Conn., and Ann Arbor, Mich.). My determination of this was confirmed by Mr. Wolle. Specimens have several times been found with one semi-cell typical and the other exactly like *St. crenulatum* (Naeg.) Delp.

St. irregulare West (Conn., N. Y.), Fig. 10. I refer here a small species which I have had under observation for several years. Since the plate for this paper was prepared this species has been described by W. West in the Journal of the Royal Micr. Society for 1894. I have not yet seen the paper, but through the kindness of Prof. Nordstedt have received tracings of the figures. The American specimens average 18–20 μ in diameter (with the rays), and 20–25 μ in length; isthmus 6 μ.

St. leptocladum Nordst. (N. Y. and Ann Arbor, Mich.), Fig. 2. The specimens are not exactly like Nordstedt's figures.‖ The base of the semi-cells is shorter, and on the end there is a double row of large divided granules along each side. The differences do not seem great enough to justify separation as a species or even as a variety.

‖ Desmidiae Brasiliae. Aftryk af vidensk. Medd. fra den Naturh. Forening i Kbhvn., p. 218, *Pl. 4, Fig. 57* (1869).

St. leptocladum Nordst. var. *cornutum* Wille (Conn.) Fig. 3. The semi-cells show a row of short downward-pointing spines around the base; otherwise the specimens are like the original figures.

St. Ophiura Lund. (N. Y. and Conn.). Frequent. Most of the specimens have but five or six rays, though a few show seven or eight.

St. quadrispinatum Turn. (Edgemoor, Ind.).

St. Ravenelii Wood (Northfield, Mich.). The specimens do not show such an irregularity of the spines as mentioned by Wolle.

Xanthidium cristatum Breb. and *X. fasciculatum* Ehrenb. have been frequently found, but by far the most common form is that shown in Fig. 1. It is probably a form of *X. antilopæum* (Breb.) Kutz, var. *Minneapoliense* Wolle, but the spine on the side of the cell arises invariably *below* the row of granules. Moreover, there is a fifth spine on each end of the cell, nearly between the lower pair. In rare cases this is short or lacking. Prof. Nordstedt has figured [¶] a cell of *X. antilopæum* (Breb.) Kutz, var. *polymazum* Nordst, one semi-cell of which shows this extra spine as a short stub. As the species seems so variable, it is hardly advisable to give a special name to this form, which doubtless runs into the others.

Besides the above named Desmids several new species have been found, and descriptions of them are here given.

Cosmarium nudiceps n. sp., Fig. 12. Length of cell 1⅓ times its breadth. Sinus deep, nearly linear. Semi-cells almost semicircular, with two granules, one above the other at the base, and often traces of one or more above. On the side of the semi-cell and within the margin, nine diverging rows of large granules, the middle, with the first and third on each side, of three; the second of four and the outer of two. In vertical view elliptic with a band through the center bare, and the granules on each side. Length, 48–50 μ; diameter, 36–40 μ; thickness, 25 μ; isthmus, 12–14 μ.

Type in Herb. Johnson, 214. New Baltimore, Mich.

[¶] Bidrag till Kännedomen om sydligare Norges Desmidiéer, *pl. 1, fig. 20* (1873).

This seems nearest *C. trinodulum* Nordst. (De Alg. et Char. 1: *pl. 1, fig. 4*), but differs in its larger size and the different arrangement of the granules.

Cos. angulare n. sp., Fig. 14. Length and breadth nearly equal. Sinus deep, linear. Semi-cells unequally hexagonal, with all the angles but those at the apex thickened or even slightly papillate. Sides diverging slightly from the basal angles to near middle of semi-cell, then sloping strongly to the truncate ends. In vertical view narrowly elliptical, with two papillæ near the middle and a smaller one at each end. Viewed from the side circular with a papilla on each side. Length 30–32 μ; diameter 26–30 μ; thickness 12 μ; isthmus 8–10 μ. Type in Herb. Johnson, 280. New Baltimore, Mich.

Staurastrum gyrans n. sp., Fig. 4. Length one-half the breadth. Semi-cells subcuneate, top slightly convex; angles prolonged into slender, slightly incurved rays. Margins of rays serrate-dentate, apices bearing each three short spines. In vertical view 5-radiate; at the base of each ray, on the left side, a strong horizontal spine. Length 20–25 μ; diameter with rays 40–48 μ, without rays 12 μ. Type in Herb. Johnson, 239. Cold Spring Harbor, N. Y.

St. bicoronatum n. sp., Fig. 9. Breadth greater than length. Semi-cells subhexagonal, top somewhat rounded; angles prolonged, each into a ray with three or four serrations, and apex trifid. At base of each ray on the upper side a stout forked spine. Above and between these two smaller ones below the end of the semi-cell. In vertical view triangular, the angles prolonged into serrate rays; two forked spines projecting beyond the margin on each side, with six smaller ones within the margin, forming a circle around the center. Length 14–16 μ; diameter (including rays) 22–25 μ; isthmus 6 μ. Type in Herb. Johnson, 221. Bridgeport, Conn.

In form this is somewhat like *St. proboscideum* (Breb.) Arch. forma *Javanica* Nordst. (De Alg. et Char. 1: p. 11, *pl. 1, fig. 19*,) but it is much smaller, and the processes are not truncate, but strongly bifurcate.

St. elegantissimum n. sp., Fig. 16. Breadth much greater than length. Semi-cells nearly square. Constriction shallow. Base of semi-cell armed with a row of short spines, sometimes with traces of a second; angles prolonged into slender slightly incurved rays armed with three spines at apex. Rays armed above and on each side with a row of sharp spiny teeth, several nearest the base bifurcate. In vertical view 4-radiate; within the margin on each side a row of several incurved bifurcate teeth, the two rows on opposite sides of the ray uniting into a median one near the middle of the ray. Length, 36–38 μ; diameter with rays, 68–72 μ; without, 16–18 μ; isthmus, 12 μ.

Type in Herb. Johnson, 276. Bridgeport, Conn.

A single specimen was found having five rays on one end of the semi-cell. All the others were typical.

BOTANICAL LABORATORY, UNIVERSITY OF MICHIGAN.

Explanation of Plate 211.

(Reduced one-fourth in photographing.)

a, front view of cell; b, vertical view; c, side view.

1. Xanthidium antilopasum (Breb.) Kutz., var. Minneapoliense Wolle, forma. ×560.
2. Staurastrum leptocladum Nordst. ×560.
3. " " var. cornutum Wille. ×560.
4. St. gyrans n. sp. ×770.
5. Cosmarium cyclicum Lund. ×560.
6. C. impressulum Elfv. ×770.
7. C. subglobosum Nordst. ×770.
8. Euastrum binale Ralfs. var. insulare Wittr. ×770.
9. St. bicoronatum n. sp. ×1150.
10. St. irregulare West. ×1150.
11. C. sulcatum Nordst. ×560.
12. C. nudiceps n. sp. ×560.
13. C. calcareum Wittr. ×770.
14. C. angulare n. sp. ×770.
15. Onychonema leve var. micracanthum Nordst. ×770.
16. St. elegantissimum n. sp. ×560.
17. C. tessellatum (Delp.) Nordst. ×560.

Recent Discoveries of Cycadean Trunks in the Potomac Formation of Maryland.

BY LESTER F. WARD.

Scarcely any fact is better known to palæontologists than that of the discovery by Philip T. Tyson, in 1859, of two large cycadean trunks and some other fragments in the iron ore region of Maryland. These were not described at the time, and were only briefly mentioned in his first report as State Agricultural Chemist, published in January, 1860 (p. 42), where he refers to them as "A new genus of a Cycas, of large dimensions, which will be described on another occasion." In immediate connection with this he also mentions "silicified coniferous wood," and "lignites (coniferous)." These he says were found in the "Iron Ore Clays (No. 22 in the illustrations)," and in the accompanying map he indicates the position of the Iron Ore Clays. The exact locality at which these trunks were found is not stated in Tyson's report, but Professor Uhler in the Transactions of the Maryland Academy of Sciences for 1888 (**1**: 7–8) says that "one specimen came from the iron ore beds of Mr. J. D. Latchford, near Muirkirk, a second from the vicinity of Hyattsville, and a third from similar clays next the shore of the Patapsco river at the Spring Gardens, south of Baltimore." From information in his possession Professor Uhler has also informed me of the discovery of apparently another specimen near Beltsville, on the property of Mr. Emack; also of a small fragment on the property of Dr. J. D. Jenkins, near Muirkirk. Professor Uhler has also mentioned to me the occurrence of still another specimen in the vicinity of Baltimore, which he was at the time negotiating for, but had not yet secured. These facts seem to constitute all the information in the possession of the scientific world relative to the occurrence of cycadean trunks in the State of Maryland down to the year 1893.

The description promised by Tyson never appeared, but a photograph of one of these specimens was made by him and distributed to the leading geologists of this country and Europe, a copy of which has recently come into my possession. Sir William Dawson, to whom a photograph was sent, showed it to Mr. William Carruthers, who mentioned it in a postscript to his important memoir "On Fossil Cycadean Stems from the Secondary Rocks of Britain,"* and says: "It is obviously a species of *Bennettites*, with smaller leaf-scars than those in *B. Saxbyanus*."

In his Flora of the Potomac Formation,"† Prof. Wm. M. Fontaine describes four specimens, consisting of two trunks and two fragments. From what he says of the localities (pp. 188, 193), they are evidently the same that have already been mentioned, although the precise language used in describing these localities is somewhat different from that given by Professor Uhler. Professor Fontaine, in his laudable desire to do the maximum honor to the original discoverer, created a new genus of these forms and called them *Tysonia Marylandica*. As it turns out he would have accomplished his object much better had he given Tyson's name to the species instead of to the genus, since the latter cannot stand, as these forms obviously belong to the genus Cycadeoidea of Buckland, which was indeed recognized by Professor Fontaine, when, in a paper to the American Journal of Science,* in 1879, he used the name "*Cycadoidea*" in referring to these very specimens. At the same time, by the laws of nomenclature now so rigidly enforced, the species cannot be changed, and the name of Tyson drops out entirely.

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* Trans. Linn. Soc. **26**: 708, 1870.

† Monographs of the U. S. Geol. Survey, **15**: 186–193, *pl. clxxiv.–clxxx.*, 1889.

The object of the present paper is to record the recent discovery and collection by Mr. Arthur Bibbins, Curator of the Museum of the Woman's College, Baltimore, of no less than thirty-five additional specimens of cycadean trunks and parts of trunks from the same general region as that in which Tyson's specimens were obtained. This I regard as one of the most important events in the history of palæontology in America, as it brings together such a body of facts relative to the cycadean vegetation of the Lower Cretaceous in Maryland that it will now be possible to give something like a complete history of that type of plants.

The specimens are all good, many of them extraordinarily fine. Nearly half of them are so complete that they may correctly be called trunks, and show nearly or quite all that was ever present; although often much distorted by pressure, and more or less flattened either laterally or vertically. Many of the remaining fragments show fully half the trunk, and have the advantage of exposing, on the broken side, the inner parts, the medullary axis, woody zones, and sections through the cortical portions. In several cases the scars produced by the separation of the medullary axis from the outer parts are very distinctly shown, and in one specimen we have a true *Cycadomyelon*, to the side of which the exterior portion of the trunk is attached for some distance, thus demonstrating for the first time the true nature of *Cycadomyelon*. In a number of the specimens the "crow's nest" is distinctly seen, but in several cases there is in the center of this crow's nest a prominent boss, symmetrical in form and conical in shape, which appears to be the terminal bud, which was petrified entire after it had been developed at the apex of the trunk.

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* III., 17: 157.

It is fitting for many reasons that this event be made known to the scientific public. It is not necessary, of course, to dwell upon its scientific importance, but not only should the great service which Mr. Bibbins and the Woman's College have rendered to palæobotany be publicly recognized, but the manner and method by which this result has been accomplished should be set forth as an example of what a correct method is capable of accomplishing, and as a hint to others who may be engaged in similar lines of research.

The collection is primarily the result of the policy of the Woman's College in seeking to supply its students with scientific material to work upon. The Woman's College is a young institution founded some six years ago, but it is one which is rapidly coming to the front and cannot fail to take a place among the first of its class in the country. Its president and founder, Dr. John F. Goucher, to whose efforts its success is so largely due, is a man who possesses all the qualifications for the position he holds. The standard which he has set up is that of the highest excellence, and visitors to that college have only to look around to see that nothing has been left undone to place it in the front rank of institutions for the higher education of women. Its scientific departments are strong, being largely officered by graduates of Johns Hopkins and other leading universities. A museum has been established in connection with the scientific instruction, and an effort is being made to equip it with everything necessary for the successful study of nature, and Dr. Goucher does not believe, as so many seem to do, that nothing has value in a museum which has not been brought from some remote region.

In appointing Mr. Bibbins curator of the college the right step has been taken to further these ends. A post-graduate of Johns Hopkins at the time of his appointment, Mr. Bibbins has been trained to the best scientific work. He is naturally endowed in a high degree with true scientific instincts as well as with practical judgment and good sense. It is these qualities which have led him to adopt an entirely new method in searching for scientific material. Knowing the rarity of fossil cycadean trunks and their great value to science, he set himself the task of trying to secure some of these for the college museum. But, instead of undertaking a hopeless and aimless quest, as has been done by geologists and collectors in the past, he chose to avail himself of the knowledge of the inhabitants of the districts in which the cycads were believed to occur. Supported by the Woman's College, which furnished him the means of transportation and met the small expense of his work, including an occasional *pour boire* to some needy farmer or miner who possessed information of great value, and usually gave it freely, he proceeded to visit the houses of the native population, and placing himself on a level with their powers of understanding, he was able to interrogate a large number of persons in such a way that they could not fail to comprehend his meaning. Having secured one specimen, he carried it about in his wagon and showed it to all whom he met. His surprise was great to find that a large proportion of the inhabitants of the iron ore districts had at some time in their lives seen similar things and were able to recognize them. In some cases a person to whom he would show his specimen would reply at once that there was such a stone in his barnyard or near his house, and by a very little negotiation he was able easily to secure it. By far the greater number, in fact nearly all, of the specimens were thus found in the possession of the people. Many of them could remember having ploughed them out of their fields, or taken them from their ore pits; others there were that had lain so long around farm houses whose occupants had several times changed that it was impossible to trace them to their original source, but usually even in such cases there was a tradition lingering in the family with regard to the peculiar stones. The reason why they were so universally picked up and brought to the house or the workshop or the barnyard or laid up in some conspicuous place seems to be that their peculiarity was instantly recognized. A countryman knows every stone that he has seen about his place, and if there be one which differs markedly from all others, especially if it has a certain symmetry of form or shows unusual and regular markings, he at once distinguishes it, is impressed by its appearance, and probably, at first at least, couples with the notion of its strangeness some vague idea of its possible utility or money value. He therefore invariably picks it up and sequestrates it in some way. After many years, finding that there is no demand for it, that no one knows any use to which it can be put, he eventually loses interest in it, and it is pushed aside, forgotten, and perhaps covered up in some obscure corner. So that in addition to the specimens that Mr. Bibbins actually obtained, there remain quite a number which are known to exist, but which for the present cannot be found.

Mr. Bibbins always frames his questions with skill, taking care not to ask leading ones, realizing that the desire to please is liable to color the answer and make it conform to what it is supposed he desires to have said. He therefore always takes pains to induce these people to tell what they know independently of any suggestion on his part.

As an illustration of the accuracy with which such persons often observe and remember facts, may be mentioned a case in which one of these traditional lost specimens was being inquired after from an octogenarian who remembered seeing it some forty years before, and when asked if the "holes" in the stone were "round" he replied, "No, they were sort o' three-cornered," a remark which rendered it certain that the object was really a cycad.

When, in January last, I learned that this collection was being made, I immediately commenced making inquiries in regard to it. I was much interested in the subject from two points of view: first, in the hope of settling the question of the exact geological position of these remains; and secondly, in the hope that an opportunity might be secured of studying this collection in connection with that of a similar one from the Black Hills of South Dakota, which had been obtained by the National Museum, and upon which I was then engaged. My efforts were met in a liberal spirit, both by President Goucher and Mr. Bibbins, and the general result has been that the entire collection has been loaned to the National Museum and placed in my hands to be described and illustrated in a memoir which is now in preparation on the Fossil Cycadean Trunks of North America, in which it is expected that nearly or quite every specimen known from any part of the United States will be included. Prof. F. H. Knowlton will be associated with me in the publication of this memoir, and to him will be entrusted the important subject of their internal structure.

With regard to the first of the two above-named objects which I had in view, I may mention that the Woman's College has afforded me the much-prized opportunity of spending a week in the field with Mr. Bibbins in visiting all the localities at which the trunks have been found. In most cases, as already remarked, they were found by Mr. Bibbins at different places from those in which they had been first discovered, but there was always some quite definite knowledge to be obtained as to the original localities. These were themselves, it is true, often little calculated to throw light on their geological position, the earliest history in many cases not going back of a time when they were seen in some field or by the roadside in the country. I may here say in anticipation of what will be said in the general report now in preparation for publication by the Geological Survey on the geology of the Potomac formation, that in the course of the last five or six years, during which time I have been more or less actively engaged in the study of that formation, I have been able with some success to subdivide it into no less than six somewhat distinct horizons, and it was therefore directly germane to my investigations that the horizon to which the cycads belong should be fixed with certainty. Tyson, as has been seen, reported that they were found in the iron ore clays, and it has been the general belief ever since that this was their position. I had observed that the large quantities of silicified wood and most of the lignites that occur in this formation come from a much lower horizon, viz., that of the Fredericksburg freestone, which in Maryland is never hardened into rock, but exists in the form of loose sand and gravel, as indeed it does to a large extent in Virginia. Having found silicified wood immediately associated with the cycadean trunks of the Black Hills, and having also learned that it occurs in the same beds in which Professor Cragin found a similar specimen in Southern Kansas, I had suspected the possibility that the same would prove to be the case in Maryland, a view which Professor Fontaine had held for some time, but we had been unable to find any cycads in place. It is a significant fact that in the photographic view made by Tyson large pieces of petrified wood stand side by side with the cycadean trunk, and, as already stated, he says that this occurs in the same beds. Although it proved very difficult to locate those of Maryland, still, in consequence of the very large number that have been found, it was possible, by the ordinary application of geologic reasoning, to trace these with greater or less certainty to their original position. There is only one case in which the exact spot was pointed out to us at which a specimen had been seen firmly adhering to and projecting from an original exposure. This was circumstantially described to us by a man who was undoubtedly altogether worthy of belief, and who, moreover, could have had no object in coloring the facts. He placed his hand on the spot where he had seen the stone projecting for many years, and stated that it subsequently fell out and rolled down into the bottom of a deep gulch, where it lay for a number of years longer, being carried with each season's freshet further and further down the gulch. At last his curiosity led him to pick it up and take it to his house, where Mr. Bibbins obtained it. If this information is reliable, which there is no reason to doubt, this specimen, at least, originally occurred in the "paint stone," which I have ascertained to belong to the same horizon as that of all the silicified wood. There are several other cases in which the position of the specimens could scarcely have been different from that of this one under any of the ordinary processes by which they were carried to the places where they were found, and there is not a single case which negatives the possibility of a similar origin. I regard the conclusion as altogether reliable that all the fossil cycadean trunks of Maryland were primarily entombed in the sandy deposits underlying the iron ore clays.*

Taking these facts in connection with the general flora of that horizon, so abundantly developed in certain parts of Virginia, we are in position to form a somewhat correct idea of the nature of the vegetation that then occupied the region along that important line upon which the cities of New York, Philadelphia, Wilmington, Baltimore, Washington, Fredericksburg, Richmond, Petersburg and Weldon—or from the Hudson to the Roanoke—are situated to-day. Leaving out of account the abundant herbaceous vegetation which carpeted the ground and filled the swamps and marshes, the general picture arises in the mind of a great Sequoian forest, furnishing the silicified wood, in the midst of which, corresponding to the shrubby undergrowth of modern forests, were everywhere to be seen these short cycadean forms from six inches to two feet in diameter and rising from a few inches to several feet above ground, crowned at their summits by tufts of large palm-like or fern-like leaves, of striking aspect and great beauty.

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* This refers to the so-called "brown ore" only. The "white ore" is found in the dark, carbonaceous clays below the paint stone.

There is quite a remarkable parallelism between the history of the discovery of these cycadean forms in Maryland with that which has recently been so graphically characterized by Senator Capellini in a monograph published jointly by him and Count Solms-Laubach on the Cycadean Trunks of the Italian Museums.*

The historical part of this memoir, written by Senator Capellini, has all the interest of a romance, and he enters into a minute description of the mode of occurrence, the original discovery, and the final disposition of the large number of objects of this class which have been found in Italy and have made their way to the several museums of that country. The literature itself dates back to 1745, while many of the specimens have been known for a much longer period. And some of these, though recently discovered, were found, like those of Maryland, in places where they had been placed at a very early date. One of them was found in a wall of great antiquity in the city of Verona, and another was taken from the top of a tomb in the ancient Etruscan Necropolis of Marzabotto, where it had been placed by the remote ancestors of the modern Italian race, either as an ornament, or in commemoration of some symbolic rite. Thus does the history of science repeat itself, and the new chapter, which has just been opened, is not the least interesting one of that history.

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*I tronchi di Bennettitee dei musei Italiani. Notizie storiche, geologiche, botaniche, dei Professori Senatore G. Capellini e Conte E. Solms-Laubach. Mem. Real. Accad. Sci. Ist. Bologna (V.), 161–215, *pl. 1–5.*

Studies in the Botany of the Southeastern United States.—II.

By John K. Small.

(Plate 212.)

Isoetes melanospora Engelm. Trans. St. Louis Acad. Sci. 3: 395 (1877).

Up to the present time this *Isoetes* has not been known to occur at any but its original locality, Stone Mountain, Georgia, where Mr. Canby discovered it in 1869. During the past season I found it growing on Little Stone Mountain, Georgia, in shallow pools in the granite rocks, just as it occurs at the original station.

Xyris neglecta n. sp.

Annual, mostly strict, slender. Root fibrous; scapes usually two to four, sometimes one, 1–4 dm. long, ribbed with ten ridges, eight of which are arranged in pairs, two on either side of a line connecting the two most prominent ones, spirally twisted and sometimes slightly flexuous when old; sheath of the scape 4–6 cm. long, more or less reddish at the base; leaves linear, 3–10 cm. long, .3–.5 cm. broad, acute, straight or slightly curved, rather erect, 4–7-ribbed; flowers bright yellow, 3 mm. broad; petals irregularly erose; fruiting spike ovoid, 4–9 mm. long, acute; the scales orbicular-obovate, 3–5 mm. long, entire at the apex, imbricated in 6–7 rows; lateral sepal 4 mm. long, fimbriate-winged for ¼–⅓ of its length from the summit; seeds oblong, pointed at both ends, irregular in outline, furnished with tails equal to or longer than themselves.

Found by Mr. A. H. Curtiss growing in moist pine woods about Jacksonville, Florida, on August 11 and October 30, 1893, in company with *Xyris ambigua*, to which species it is related, but easily separated by its smaller size, shorter leaves and more slender spikes so far as the outside characters are concerned. The lateral sepal is also very differently crested and the seeds are smaller, narrower and more pointed. One of its strongest characters is the peculiarly ridged scape as described in the above diagnosis. The scape of *X. ambigua* is oblong in cross section and strongly two-ridged.

SMILAX ROTUNDIFOLIA CRENULATA Small & Heller, Mem. Torr. Club, **3**: 17 (1892).

Grows in similar localities at Tallulah Falls, Georgia, especially at the bottom of the deep cañon, as in the forests on Grandfather Mountain, North Carolina, the original station.* The plants are almost identical with the type and exhibit well the principal characters. The lanceolate leaves and the erose-crenulate margins are particularly striking. We now have this form from Southwestern Virginia, North Carolina and Northern Georgia, and may expect to find it at intermediate places along the mountains.

CELTIS RETICULATA Torr. Ann. Lyc. N. Y. **2**: 247 (1825).

There exists in the valley of the Yellow River, about eighteen miles east of Atlanta, Georgia, a slender *Celtis* with remarkably small leaves and of a diffusely branched habit. In some respects it differs from any form yet described, but is nearest to *C. reticulata* Torrey, a species of the Southern Rocky Mountain region.

The specimens are so similar to that species that I consider it better to place it there than to describe it as new. This form agrees very well with Dr. Torrey's type, differing principally in the smaller and acute or acuminate leaves, which do not vary much from an inch in length. Those of the type specimens are mostly obtuse and some an inch and a half long. However, we have specimens almost identical with mine from Santa Cruz Valley near Tuscon, Arizona (Pringle), and cañons in the Burro Mountains, New Mexico (Rusby). The leaf form of the plant under consideration corresponds almost exactly with those collections.

At first I thought this form might be *C. pumila*, but an authentic specimen of Pursh's plant in the Columbia College Herbarium shows that it is a form of *C. occidentalis*.

PRUNUS NIGRA Ait. Hort. Kew. **2**: 165 (1789).

In the Silva of North America, Prof. Sargent has reëstablished and given us a clear conception of this good species. I have recently (August 11, 1893) discovered a grove of this plum in the foothills of the Blue Ridge between Tallulah Falls and Toccoa

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* Mem. Torr. Club, **3**: 17.

Falls, in Northern Georgia. The foliage, fruit, stone, etc., of my specimens are similar to those figured by Prof. Sargent in his Silva. The range given for the species extends only as far south as the valley of the St. Lawrence; however, the tree is probably more widely distributed than we are aware of, and we would naturally expect to find it in and about the Appalachian Mountain System.

The species is easily separated from *P. Americana* by its larger leaves, the larger and oblong fruit, and the strongly crested stone. The leaves of *P. Americana* are rather small, the fruit globose and the stone without a crest.

TRIFOLIUM SAXICOLUM n. sp.

Perennial by a strong root and numerous stolons, stout, glabrous, much branched from a woody base, procumbent, sometimes slightly ascending. Branches more or less creeping, the older portions becoming woody and covered with dry, membranous, chaffy stipules; internodes short, 3–17 mm. long, increasing in length towards the ends of the branches; leaves palmately-trifoliolate, numerous, rigid; stipules 6–8 mm. long, lanceolate, very acuminate, partly sheathing the branches; petiole .5–2.5 cm. long; leaflets obovate or obcordate, 3–8 mm. long, short-stalked, sometimes emarginate, with very sharp spine or prickle-like teeth except near the base, teeth sometimes double; secondary nerves straight and parallel, sometimes forking near the margin; peduncles five-angled, 2–6 cm. long; heads 40–70 flowered, rather dense; flowers white, drooping on deflexed pedicels in fruit; calyx narrowly-campanulate, 3 mm. long, cleft to the middle into fine subulate teeth, upper teeth shorter than the lower ones; corolla twice or thrice as long as the calyx when mature; vexillum undulate on the borders, erose at the apex; legume 2 mm. long, one to three-seeded, style persistent; seeds 1 mm. long, orbicular, ovoid, smooth, orange colored or reddish.

Found at the southern base of Stone Mountain, Georgia, growing in the loose piles of granite, altitude 1,100 feet. Not observed elsewhere in the mountain or vicinity. (Plate 212.)

The species is related to *T. Carolinianum*, but is separated from that and all our other species by its strong characters mentioned above.

TRIFOLIUM HYBRIDUM L. Sp. Pl. 766 (1753).

Although extensively naturalized and thoroughly established in the Northern States, this species has been slow in securing a hold in the South. So far as I can learn it has not been observed south of Virginia, except about the village of Stone Mountain, Georgia, when I found it well established last July.

CRACCA INTERMEDIA n. sp.

Perennial by a woody base, pubescent throughout and slightly viscid about the nodes. Stems 4–6 dm. long, branched from the base and throughout, spreading, assurgent, flexuous and more or less angled; leaves oblong-obovate in outline, 6–12 cm. long, 3.5–6 cm. broad; petioles 1–2 cm. long, rachis four-angled; leaflets 7–11, oblong-obovate, 1–3 cm. long, .7–1.7 cm. broad, strigose on the lower surface, glabrous on the upper surface, truncate or slightly emarginate at the apex, more or less apiculate by the excurrent midrib, very short petioluled; peduncles as long as the leaves, four-angled; pedicels 6–8 mm. long; flowers dark red, 1.3–1.7 cm. long; calyx teeth lanceolate, acuminate; legume 3.5–4 cm. long, either solitary or two arising from the same place; seeds five to nine, oblong or oblong-ovoid, compressed, smooth and variegated.

Intermediate between *Cracca ambigua* and *C. chrysophylla*, but of the two, more closely related to the latter, from which, however, it differs in its assurgent habit, the greater number and the shape of the leaflets, the smaller flowers and larger seeds. The habit of *C. chrysophylla* is strictly prostrate, the leaflets are 5–9 in number, and obovate-cuneate in outline. The seed is only one-half as large, dull and slightly roughened, and obliquely-obovoid in shape. *C. intermedia* also lacks the silky pubescence of *C. chrysophylla.*

The species grows in dry and poor "blackjack thickets" about Jacksonville, Florida, and was found by Mr. A. H. Curtiss in 1893, flowering on May 31st and in mature fruit on July 11th.

HIBISCUS SYRIACUS L. Sp. Pl. 695 (1753).

Is thoroughly established about Stone Mountain, Georgia.

PHACELIA DUBIA (L).

Polemonium dubium L. Sp. Pl. 163 (1753).

Phacelia parviflora Pursh, Fl. Am. Sept. 140 (1814).

PHACELIA HIRSUTA Nutt. Trans. Amer. Phil. Soc. (II.) **5**: 191 (1833–37).

Phacelia parviflora var. *hirsuta* A. Gray, Proc. Amer. Acad. **10**: 320 (1875).

Last year I had an opportunity to study this plant in the field in both the flowering and fruiting state, and have been lead to the conclusion that Nuttall was right in considering it a species. In April I encountered the plant in flower on Stone Mountain, Georgia, where it grows at altitudes ranging from 1,000–1,400 feet, and in July in fruit. Being well acquainted with *P. dubia* the dissimilarity between the two forms was striking and in the living state *P. hirsuta* does not exhibit much likeness to *P. dubia*.

The plant is of a shorter and stouter build, erect and of a firm texture, and the racemes crowded even in fruit, whereas *P. dubia* is elongated, slender, spreading and with early interrupted racemes. The flowers and fruit furnish good distinctive characters: The corolla of *P. hirsuta* ranges from 13–15 mm. in breadth and the segments strictly entire, while that of *P. dubia* is only 8–11 mm. broad and has the segments more or less erose. The color of the former is dark purple, or, according to Nuttall, "purplish blue," and its pod is less compressed than the latter; the seeds are twice as large, covered with large papillæ. The pod of *P. hirsuta* is orbicular, rather broader than high, opposed to the broadly oblong pod of *P. dubia*.

PENTSTEMON SMALLII Heller, Bull. Torr. Club, **21**: 25 (1894).

Mr. E. P. Bicknell has lately discovered this handsome species at Nashville, Tennessee. He remarks that it grows plentifully on the bluffs of the Cumberland River about that city. Two forms were noticed and collected by Mr. Bicknell; the one has glabrous leaves as in the type, while in the other both the upper and lower surfaces of the leaves are canescent. I never noticed this latter character on any of the numerous plants observed and collected by Mr. Heller and myself in the mountains of North Carolina. It is probably due to local influences. The plants were in full bloom during the first weeks of May. The above collection extends the geographical range of this *Pentstemon* about two hundred miles to the west, Knoxville being previously the western known limit.

CUSCUTA ARVENSIS Beyrich; Hook. Fl. Bor. Am. **2**: 77 (1834).

Grows about the base of Stone Mountain, Georgia, in mats on *Gymnolomia Porteri*, where this species forms dense patches. There its color is not "pale," but a rather dark yellow. The young corolla, scales, etc., correspond to Mr. Matthew's figures;* but one corolla-segment is always narrower than the other four, sometimes only one-half as broad. This is probably a transition to a four-cleft state of the perianth which exists in some species. The filaments on the persistent corollas develop so as to appear as small segments, carrying out the fringed scale with them.

LONICERA FLAVA Sims, Bot. Mag. *t. 1318* (1810).

Heretofore only two localities for this rare and showy *Lonicera* have been known. According to Sims,† *Lonicera flava* was discovered by Mr. Fraser and his son on the exposed and rocky summit of Paris Mountain, South Carolina, noting that they failed to find it elsewhere. In 1836 Dr. Boykin found the species in the "upper districts of Georgia," but unfortunately failed to give any definite station. In April, 1891, Mrs. J. G. Smith rediscovered it at the original locality.

About the middle of April, 1893, I encountered the plant in full bloom on the summit of Little Stone Mountain, Georgia. This mountain is situated south of Stone Mountain, distant about nine miles. It is a flat, granite dome, rising about one hundred and fifty feet above the surrounding plain; the slopes are nearly bare, consisting of flat, granite pavements, but a small area of the top is capped by a layer of sandy soil several feet thick. This is covered by a rather dense growth of shrubs and trees, except the highest point, which is several square yards in extent. Here three plants of *Lonicera flava* grow, spreading over the undershrubs and the ground. The stems are covered with a loose, fibrous bark, and root freely at the nodes where they lie on the ground. It is a most handsome plant when in flower, the corolla being of a bright, golden color. On a second visit to that region in July the abundant fruit was just about maturing. During a month's exploration of the vicinty no other station was observed until my last trip on Stone Mountain, where I came upon several plants growing in the woods on the northern cliffs of the mountain.

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* Bull. Torr. Club, 20: *pl. 164.*

† Bot. Mag. *t. 1318.*

The species is evidently locally distributed, but will doubtless be found at new stations as the States of Georgia and South Carolina are better explored.

VIBURNUM FERRUGINEUM (T. & G.) Small, Mem. Torr. Club, 4: 123 (1894).

Mr. Bicknell recently brought me specimens of a *Viburnum*, from Nashville, Tennessee, saying that it was very different from anything he has previously observed and that no allowance was made for it in our manuals. It is typical *V. ferrugineum*, whose excellent characters I have pointed out in another place.* At Nashville it grows in the rocky banks of the Cumberland River in localities similar to the one on the Pinnacle at Cumberland Gap, where I rediscovered the species two years ago. Last season I also found many fine trees of this species in the bottom of a rocky cañon along the Yellow River, in Middle Georgia. The specimens from the latter locality, as well as Mr. Bicknell's, are identical with those from Cumberland Gap, in the Cumberland Mountains. The discoveries at Nashville and in Georgia do not increase the geographical range, but serve to show that the species is probably not scarce in the Southern States, but has simply been unobserved. All our Eastern specimens are very constant as to characters and habitat, the greatest variation being in the specimens from the Southwest. In these the leaves are smaller, more coriaceous and the tomentum on the petiole is more abundant.

VIBURNUM CASSINOIDES L. Sp. Pl. Ed. 2, 384 (1763).

This species was first found in the Southern States during the summer of 1891,† throughout the mountains of Western North Carolina. During the last season I encountered it first at Tallulah Falls, where it grows in the bottom of the deep cañon, and later along brooks throughout the mountains between the Tallulah River and the source of the Tennessee River, in Northern Georgia. It is the prevailing *Viburnum* in that region.

ERIGERON RAMOSUS BEYRICHII (Fisch. & Meyer).

Stenactis Beyrichii Fisch. & Meyer, Ind. Sem. Petrop. 5: 27 (1838).

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* Mem. Torr. Club, 4: 123.

† Mem. Torr. Club, 3: 6 and 27.

Erigeron strigosus var. *Beyrichii*, T. & G. Fl. N. A. **2**: 175 (1843).

This rare and distinct form has lately been collected by Dr. Mohr in Alabama, growing on calcareous hills near Russelville. The plant was first found by Beyrich in "Carolina," and later discoveries show it to range from "Carolina" to Florida, St. Marks (Rugel) to Indian Territory, on the False Washita (Palmer, 479).

COREOPSIS INTEGRIFOLIA Poir. in Lam. Encycl. Suppl. **2**: 353 (1811).

Fine specimens of a *Coreopsis*, which apparently belong to the above species, have been secured by Mr. A. H. Curtiss from the region between Jacksonville and Trout Creek, Florida. Authentic material of *C. integrifolia* is meagre, but I have carefully compared the Florida plants with it and find the two almost identical. The flowers, rays and styles are alike, and the leaves agree very well in shape, but those found by Mr. Curtiss have somewhat longer petioles. The plants grow on borders of wet thickets and were in flower and fruit on October 21, 1893.

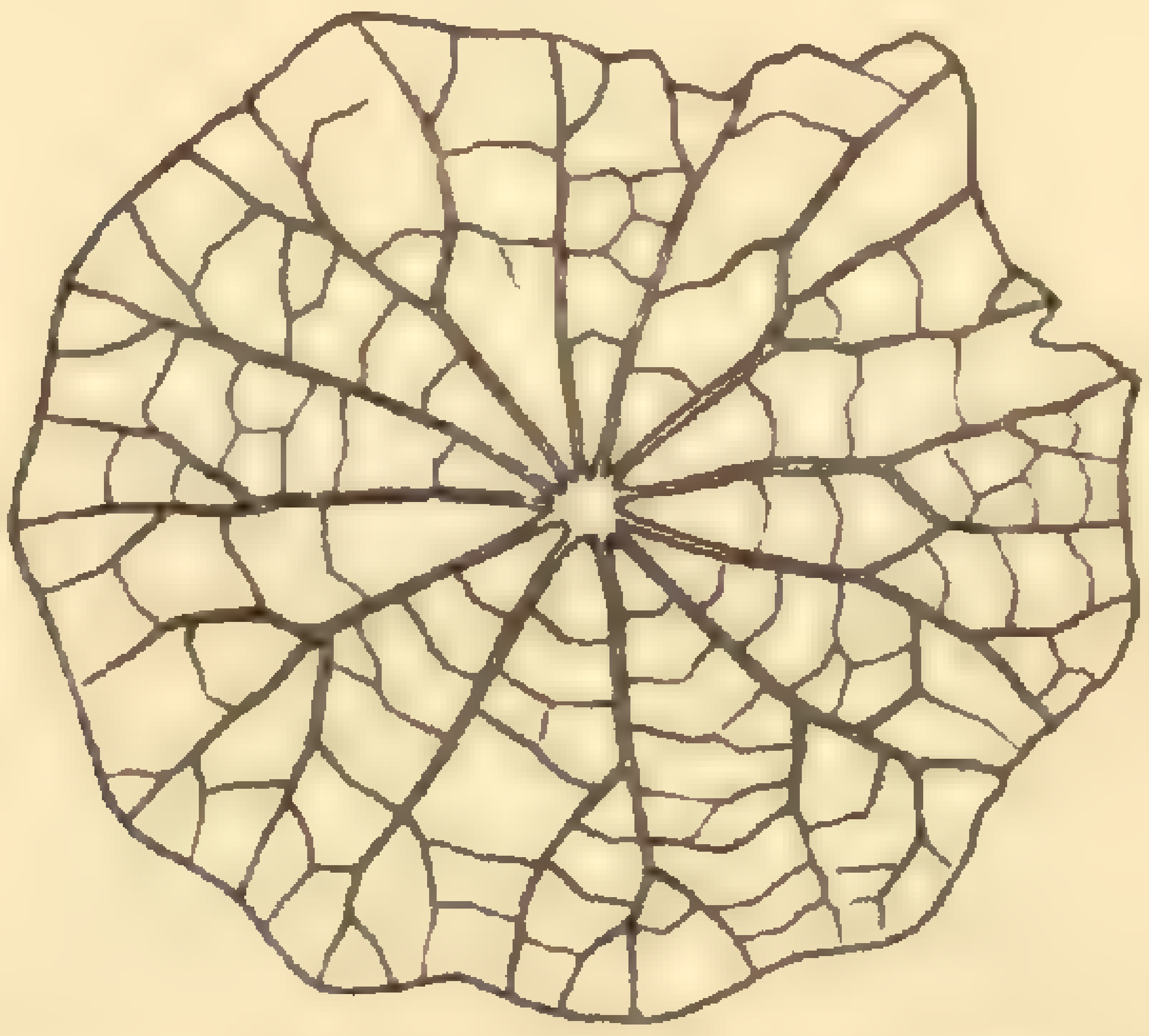
A New Fossil Nelumbo from the Laramie Group at Florence, Colo.

BY ARTHUR HOLLICK.

NELUMBO LARAMIENSIS n. sp.

Leaf orbicular, about 1½′ in diameter, with wavy margin, centrally peltate; primary nerves strong, diverging somewhat irregularly from the centre, forked 1–several times, connected by cross-nervation which is slightly angled or bent outward, especially near the margin.

This little leaf was found in a collection of fossil plants made by Mr. George Hadden from the Laramie group at Florence, Colorado, for the late Dr. J. S. Newberry. Its affinities with the genus *Nelumbo* can hardly be questioned, and it is clearly different from every other fossil species thus far described from this country. In regard to the foreign species I can not be so certain, as some of these have been described or merely named but not figured, and it is very doubtful if they all belong in the genus.* Schimper, in his Traité de Paléontologie Végétale, 3: 95, says in regard to *N. Casparianum* Heer and *N. nymphæoidea* Ettingsh.: " I do not think that the true position of these two last fossils is in the genus *Nelumbium*," but further than this I would not wish to carry the criticism without having had an opportunity to examine the material upon which the names were based. It is, however, pertinent perhaps in this place to call attention to the leaf which was described by Sir J. W. Dawson (*Brasenia antiqua* Dawson, Trans. Roy. Soc. Canada, **3, Sec. 4**: 15 (1885)) from the Belly River beds of British Columbia, representing a geological horizon practically equivalent to our Laramie. From the description and figure as given by Dawson it appears to resemble *Nelumbo* more closely



NELUMBO LARAMIENSIS HOLLICK.

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* The geological range of the genus is from the middle cretaceous to the miocene tertiary, and of the thirteen previously named species, five are American, seven are European, and one is Asiatic. For the completeness of the following references I am indebted to Prof. Lester F. Ward, of the United States Geological Survey.

AMERICAN.

1. *N. tenuifolium* Lesq. in Hayden's Ann. Rept. U. S. Geol. and Geog. Surv. 1873, 402; Lesq. Tert. Fl. 253, *pl. 46, fig. 3.*
2. *N Lakesianum* Lesq. in Hayden's Ann. Rept. U. S. Geol. and Geog. Surv. 1873, 403; = *N. Lakesii* Lesq. Tert. Fl. 252, *pl. 46, figs. 1, 2.*
3. *N. arcticum* Heer, Fl. Foss. Arct. **6, Abth. 2**: 92, *pl. 40, fig. 6.*
4. *N. Saskatchuense* Daws. Trans. Roy. Soc. Canada, **5, Sec. 4**: 35.
5. *N. pygmæum* Daws. Trans. Roy. Soc. Canada, **8, Sec. 4**: 87, *fig. 22.*

EUROPEAN.

6. *N. Buchii* Ettingsh. Sitzb. Wien Akad. **10**: 428; Denkschr. Wien Akad. **8**: 36, *pl. 10, figs. 2, 3; 11, fig. 1; 12.*

than it does *Brasenia*. Further than this, the name *Brasenia antiqua* was preoccupied at the time of its adoption by Dawson, a fact in regard to which he was apparently in ignorance (see *Brasenia antiqua* Newberry, desc. in Proc. U. S. Nat. Mus. **5**: 514 (1882); undistributed plates, Cret. and Tert. Floras, *pl. 68, fig. 7*) and as Newberry's specimen, consisting of stems and fruit only, is from the eocene tertiary, there is little likelihood that the two are referable to the same species.

Under the circumstances I would propose that Dawson's plant be renamed, in accordance with recently adopted rules of nomenclature, as follows: *Nelumbo Dawsoni* = *Brasenia antiqua* Dawson (1885), not *Brasenia antiqua* Newberry (1882).

By this means Dawson's name may still be retained in connection with the plant which he unwittingly described under a name already preoccupied.

Finally, it may perhaps not be amiss to call attention to the geographical distribution of the living species. Only two are recognized, viz.: *N. nucifera* Gaertn., ranging from the Caspian Sea to Japan and thence southward to Australia, and *N. lutea* (Willd.) Pers., ranging from Kansas and Missouri to Lake Erie and thence southward to the West Indies. It is another example of the similarity between the floras of Eastern Asia and Eastern North America which has so often attracted the attention of those who

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7. *N. nymphæoidea* Ettingsh. Sitzb. Wien Akad. **12**: 182; Denkschr. Wien Akad. **8**: 37, *pl. 10, fig. 1; 11, fig. 2.* = *N. nymphæoides* Ettingsh. (Schimp. Paléont. Veg. **3**: 95).

8. *N. Casparianum* Heer, Fl. Tert. Helvet. **3**: 299. = *N. Casparyanum* Heer (Schimp. Paléont. Veg. **3**: 95).

9. *N. microcarpum* Ettingsh. and Gard. Proc. Roy. Soc. London, **29**: 395.

10. *N. Ettingshauseni* Sieber, Sitzb. Wien Akad. **82, Abh. 1**: 83, *pl. 2, figs. 15, 16.*

11. *N. provinciale* Sap. in Saporta and Marion's L' Évolution du Règne Végètale, Phanerogames, **2**: 125, *fig. 128*; Mém. Soc. Géol. de France, **1, Fasc. 3**: 2, 5, 7, *pl. 1, fig. 1; 2, fig. 1; 3, figs. 1–6a.* (*N. gallo-provinciale* Sap. in Zittel's Handbuch der Palæontologie, 509, is a mistake for *N. provinciale* Sap., made in describing the leaf of *N. provinciale* figured by Saporta as above, in connection with a valve of *Unio gallo-provinciale.*)

12. *N. proto-speciosum* Sap. Rev. Gen. de Bot. **2**: 192; Mém. Soc. Géol. de France, **2, Fasc. 1**: 5, 17, *pl. 1, figs. 2, 3; 4, figs. 1, 2.*

Asiatic.

13. *Nelumbium* sp. Nath. Pal. Abhandl. **4**^{1}: 27, *pl. 7, fig. 20.*

are interested in the problem of the distribution of plants. In this connection the fact that the genus was of almost universal distribution in the past, at least over the whole Northern hemisphere, until comparatively recent geologic times, is of the greatest interest and significance, not only in regard to its present distribution, but also in regard to the evolution of the living species. We are no longer under the necessity of accepting the almost impossible theory that the plants have migrated in modern times from one continent to another, but are irresistibly led to the rational conclusion that, inasmuch as the genus existed on both continents until very recent geologic times, the presence of the living species in their now isolated and widely separated ranges is merely due to the extinction of plants from former intermediate localities, probably due to the vast climatic changes wrought by the advent of the Ice Age. We should also be within the bounds of reason if we supposed that the two living species may have been merged in one common ancestor at no very remote date, and that the specific differences which we now note as existing between them have resulted from differences in environment since their isolation from each other.

We may also note, as of interest, that the leaves have constantly increased in size up to the present time. The American cretaceous species, if we except *N. arctica* Heer, from Greenland, began with leaves little more than an inch in diameter. In tertiary times they had developed to a diameter of four or five inches, while at the present day they reach a size of two feet or more.

Varieties of Solidago and Aster.

SOLIDAGO CANADENSIS GLABRATA n. var.

Stems low, 2–3 ft. high, puberulent above; leaves numerous, linear-lanceolate, upper ones entire, lower ones with a few sharp serratures, smooth above, somewhat pubescent on the midrib and veins beneath; panicles small, with slender branches; heads small; bracts of the involucre acute or acutish; rays short and few.

Mt. Desert Island, Me., *Rand* and *Redfield*. At several points along the Susquehanna river, Pa. In some states it approaches *S. rupestris* Raf.

SOLIDAGO PURSHII (*S. humilis* Pursh).

The name *humilis* of Miller's Dict., n. 16, antedates that of Pursh and was given to a low form of *S. Canadensis*, included perhaps in the variety just described.

ASTER NEMORALIS BLAKEI n. var.

Stems 1–2½ ft. high; leaves not crowded, 2½–3 inches long, ½–¾ of an inch wide, lanceolate, coarsely toothed or entire, margins not revolute; heads few or sometimes solitary; rays lilac-purple.

Gilmanton, N. H., *Blake*, 1864; Mt. Desert Island, Me., *Rand*, 1893.

Intermediate between the species and *A. acuminatus*. The type is confined chiefly to the bogs of the sea coast, whilst the variety extends inland, and is found even high up on the mountains. The specimens received from Mr. Rand are nearer to *A. acuminatus* than others that have been examined.

THOS. C. PORTER.

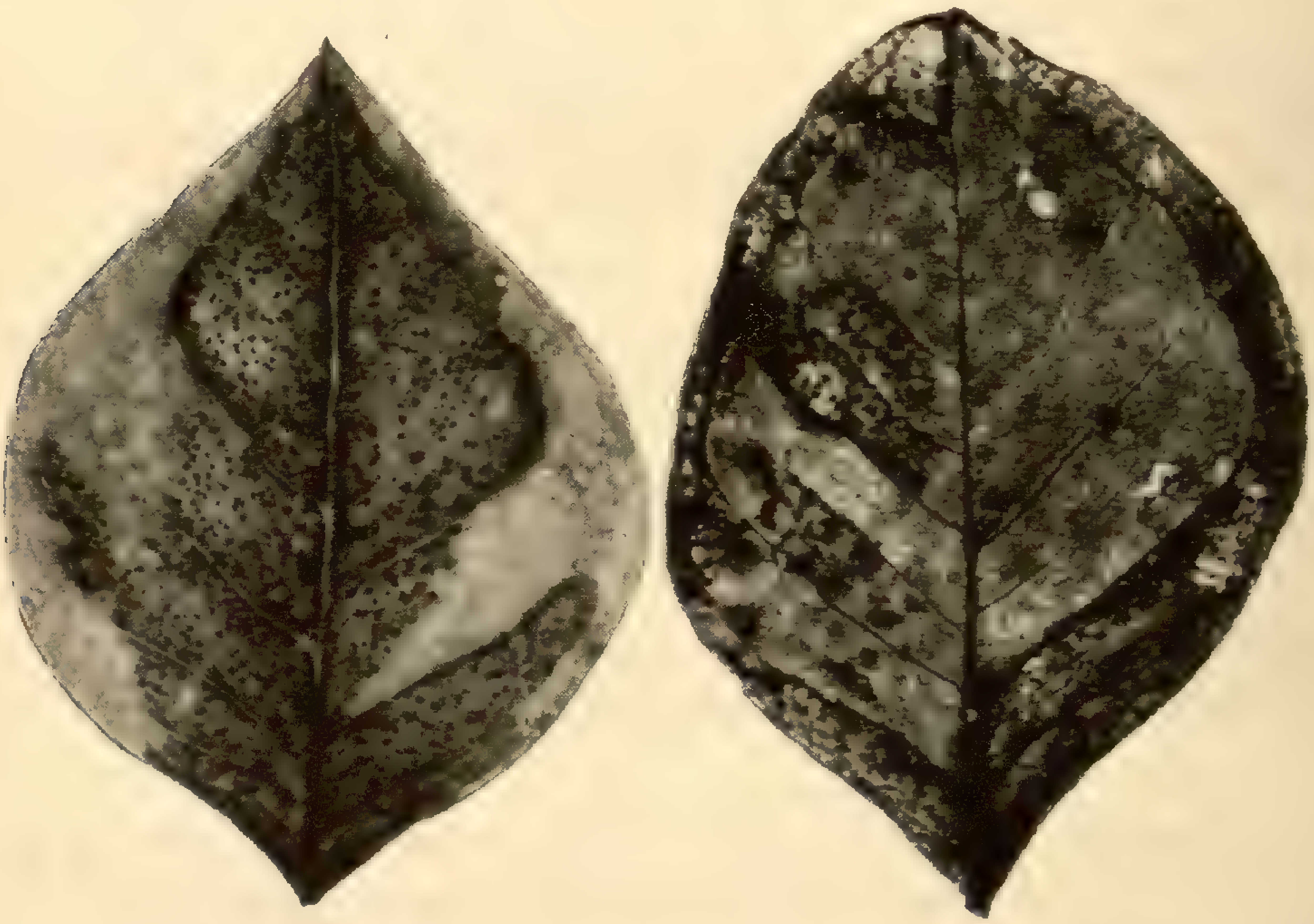
Botanical Notes.

Peculiar "Range" in an autœcious Uromyces. It goes without saying that parasitic fungi prefer certain portions of plants. Some confine themselves to the stem, others to the root, while a large number are limited in their growth to the foliage. The smuts, while wide feeders, usually produce their spores in the malformed ovary, and the ergots in a similar manner flourish in the inflorescence.

Attention is here called to the position occupied by the fruiting of two forms of a species of a rust, namely: *Uromyces Caladii*, which is very common upon *Peltandra Virginica*, and *Arisæma triphyllum*. In the former host the æcidia are confined almost exclusively to the petiole and midrib of the leaf with occasional cups along some of the secondary veins. The teleutospores, appearing later in the season, seem to prefer the blade of the leaf, but may be met with upon the petiole and midrib. In this case the greater limitation is on the side of the earlier stage of the parasite, namely, the æcidial form.

Passing now to the *Arisæma,* there is an additional point of interest in that æcidia, as before, are more limited in their range. While not producing cups upon the petiole and midrib exclusively, it is true that a margin of the leaf that lies outside of a boundary line made by the blending of sub-peripheral veins does not as a rule bear the æcidia. On the other hand, the teleutospores have a preference for this outer belt of the leaf, and frequently are not found elsewhere.

The two companion leaves in the engraving, the one of the æcidial and the second of the teleutospore form of the fungus, illustrate the point, the leaves being chosen from a few chance specimens in the herbarium. It is most likely that with a little search for them in the field much more striking examples could be found of this peculiarity in the leaf range of this polymorphic parasite.



The fact that the æcidia are most abundant upon the petiole and main vein of the *Peltandra,* and not infrequently appear upon the stem and inflorescence of *Arisæma,* would indicate that the greater thickness or greater succulence, or both combined, furnish in more favorable conditions for the development of the æcidia. In fact this, the first form of the fungus, develops its cups often before the leaf has expanded, and this element of time may be a third reason for the limitation noted. On the other hand, the outer portion of the leaf may furnish for similar reasons later in the season a better feeding ground for the subsequent forms of the rust fuugus. BYRON D. HALSTED.

RUTGERS COLLEGE, March 20, 1894.

Sherardia arvensis in New Jersey. A plant of *Sherardia arvensis* was found by Mrs. Wm. Z. Flitcraft, of Woodstown, N. J., Vice-President of the Naturalists' Field Club of that place, on May 10, 1894, in the Library Hall lot in Woodstown, owned by Mr. Flitcraft. The lot around the building has been in grass for many years, with the exception of a border around it planted in rose bushes. The plant was found in the grass plot just inside of this border. The one specimen is all that was found, and was pulled up by Mrs. Flitcraft by the root, so as to better determine its character, as the plant was altogether new to her. Miss Cornelia Woolman, a member of the Field Club, pronounced it *Sherardia arvensis*, which was confirmed by myself, and also by Prof. N. L. Britton. How it came in the lot is unknown. It may have come from seed deposited with manure or grass seed sown on some bare patches of the lawn within the past two years. It is possible that there are other roots near the place it was found, and the plot will not be mowed again for some time, so that other specimens may, if possible, be secured.

CHAS. D. LIPPINCOTT.

Note on Cassia armata. In the article on "The Genus *Cassia* in North America," which appeared in the BULLETIN for May,* the species *C. armata* S. Watson is characterized as herbaceous. Mr. S. B. Parish, of San Bernardino, Cal., has kindly informed the author that it is in reality a shrub about four feet in height, and adds the following note in regard to its distribution: "It grows in dry, rocky places in the Mojave Desert, but not abundantly. Daggett is the most western known station, and it ranges thence east, hits the adjoining borders of Arizona and Nevada. The San Diego locality quoted by Mr. Pollard is probably a mistake."

The error of calling the plant herbaceous appears in the original description, and as our eastern material is too scanty to afford any clue to the habits of the species it was naturally repeated in the article in question. C. L. POLLARD.

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* Bull. Torr. Club, 21: 221 (1894).

A Request. I will be greatly indebted to any reader of the BULLETIN who can collect for me several good specimens of any species of *Petalostemon*, especially fruiting ones, and among them at least one with root as near complete as possible. I am engaged in revising the genus, hereafter to be known as *Kuhnistera*, and need good fresh specimens from as many localities as possible. Return will be made in specimens of Texas, Virginia or North Carolina plants. I desire to receive communications on the subject. A. A. HELLER.

411 W. WALNUT STREET, LANCASTER, PA.

Note on the Genus Enslenia Nutt. This generic name, published by Nuttall in 1818 (Gen. 1: 164), is a homonym, it having been used by Rafinesque one year previously (Fl. Ludov. 35) for a different plant. Rafinesque calls attention to this fact in Am. Month. Mag. 4: 192 (1819) and proposes to substitute for it the name *Ampelanus*, but he neither cites species nor gives a description. In order to maintain Rafinesque's very suggestive name, I here designate the species:

AMPELANUS ALBIDUS (Nutt).
Enslenia albida Nutt. Gen. 1: 164.

N. L. BRITTON.

Index to Recent Literature relating to American Botany.*

Atkinson, Geo. F. *Olpitrichum*, a new genus of mucedinous Fungi. Bot. Gaz. 19: 244, 245, *pl. 23*. 20 Je. 1894.

Bailey, L. H. Some recent Chinese Vegetables. Bull. Cornell Agric. Exp. Sta. 67, pp. 32, *f. 10, pl. 2*. Je. 1894.

Several little known Chinese garden vegetables are reported upon, the most valuable being the Pe-Tsai or Chinese cabbage.

Baker, J. G. *Caraguata conifera*. Curt. Bot. Mag. 50: *t. 7359*. Je. 1894.

Native of Ecuador.

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* It is requested that omissions from this record be communicated to the Editor.

Bay, J. Christian. On Compass Plants and Twisting of Leaves. Bot. Gaz. **19**: 251, 252. 20 Je. 1894.

Bay, J. Christian. *Sachsia*, ein neues Genus der hefenähnlichen, nicht sporentragenden Pilze. Ber. Deutsch. Bot. Gesel. **12**: 90. 23 My. 1894.

Description of a new genus with one species *Sachsia albicans.*

Bay, J. Christian. The Absorption of Water by the green Parts of Plants. Agric. Sci. **8**: 109–114. Mr. 1894.

Bescherelle, Em. Selectio novorum Muscorum. Journ. de Bot. **8**: 177–179. 1 My. 1894.

Two species of *Hookeria* and two of *Leucomium* are described from Guadeloupe.

Bessey, C. E. The Structure of the Wheat Grain. Bull. Neb. Agric. Exp. Sta. **32**: pp. 14, *f. 16.* F. 1894.

Bicknell, Eugene P. On a species of *Helianthemum* not recognized in our Text-books. Bull. Torr. Bot. Club, **21**: 257–260. 20 Je. 1894.

Describes *H. Canadense* (L.) Michx. and *H. majus* (L.)

Bower, F. O. Practical Botany for Beginners. Small 8vo., pp. 275, *f. 13.* London and New York, MacMillan & Co. 1894.

An abridgement of the author's "Course of Practical Instruction in Botany."

Britton, N. L. A Revision of the genus *Lechea.* Bull. Torr. Bot. Club, **21**: 244–253. 20 Je. 1894.

Britton, N. L. *Barbarea vulgaris, B. stricta* and *B. præcox* on Staten Island. Proc. Nat. Sci. Assn. S. I. **4**: 32. 9 Je. 1894.

Britton, N. L. Thomas Morong. Bull. Torr. Bot. Club, **21**: 239–244. 20 Je. 1894.

Sketch of his life with a list of his botanical publications.

Chamberlin John. The Flowering of Blood-root. Gard. & For. **7**: 238. 13 Je. 1894.

Coulter, John M. Preliminary Revision of the North American Species of *Cactus, Anhalonium* and *Lophophora.* Contr. U. S. Nat. Herb. **3**: 91–132. 10 Je. 1894.

Descriptions of the North American species. *Lophophora* is proposed as a new genus.

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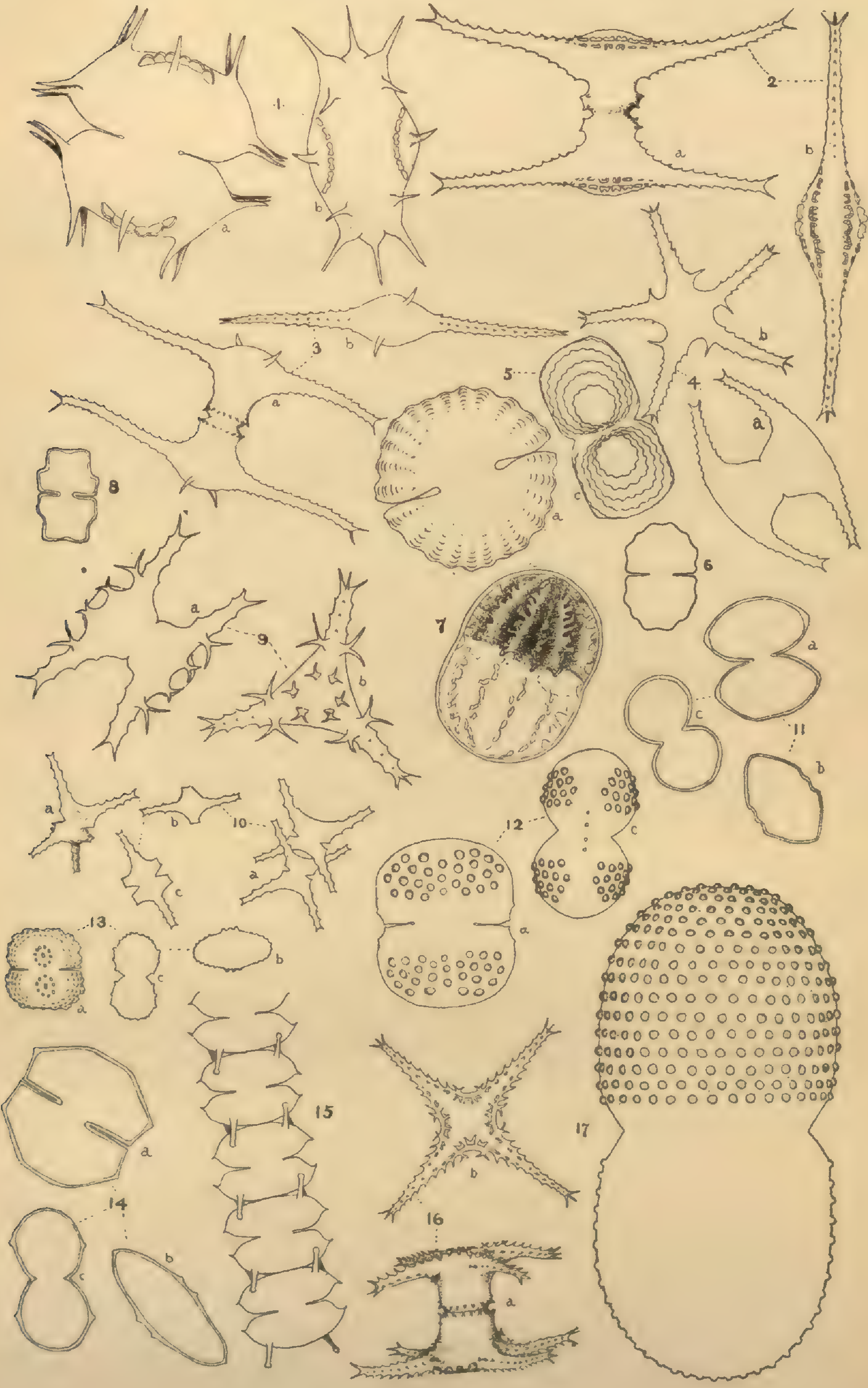
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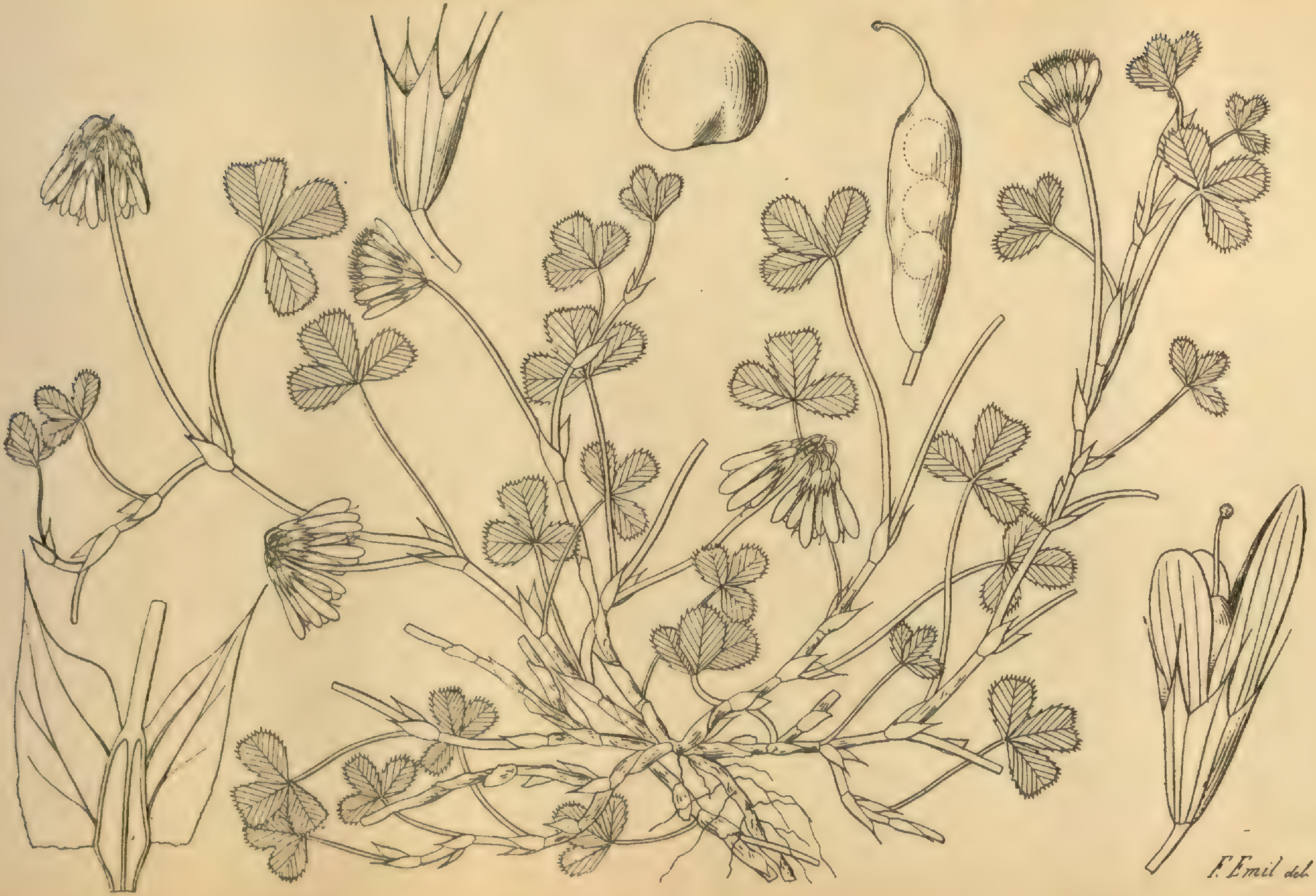

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VOL. 21. AUGUST, 1894. NO. 8.

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EDITED BY

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CONTENTS:

	PAGE.
Notes on Maize: *E. Lewis Sturtevant*	319
Contributions to American Bryology, VIII. A Revision of the Genus *Bruchia*: *Elizabeth G. Britton* (PLATES 213–217)	343
Notes on some Exoasceæ of the United States: *Geo. F. Atkinson*	372
BOTANICAL NOTES.—The Systematic Botany of North America	380
INDEX TO RECENT LITERATURE RELATING TO AMERICAN BOTANY	381

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Vol. 21. Lancaster, Pa., August 20, 1894. No. 8.

Notes on Maize.

By E. Lewis Sturtevant.

I.

The words *Zea Mays* are only fitted for generic use. So numerous and divergent in appearance and use are the varieties of corn already known that to call all by one name is to speak too indefinitely for any practical purpose. *Zea Mays* may mean the dwarf pop growing but eighteen inches tall in our gardens, or the huge something which is reported as over twenty-four feet tall in Central America—a variety so hard that the national custom is to parch before attempting to pulverize, or so soft as to readily reduce to meal on a hollow stone—a variety which, despite extensive distribution, cannot compete with a commercial form, or a form which enters into commerce—a variety whose hundred kernels weigh but 46 grains, or another whose hundred kernels weigh 1531 grains. If we consult botanies we find nothing of any help towards determining questions of climatic relation, of adaptability or environmental reaction. If we examine pages of travel, of archeology, of ethnology or of history, we fare scarcely better in securing sufficient preciseness of mention for purposes of study. From whatever point of view we attempt an examination into the natural and economic history of the maize plant and product, we meet with difficulties, usually insurmountable, arising from indefinitiveness of nomenclature.

It seems the universal experience that scientific investigation cannot be well accomplished without a distinct and sufficient nomenclature. The lack of precise names for cultivated plants has served to discourage study, and to discredit much of the work which has been inefficiently attempted. Systematic botanists at present seem to endeavor to mass divergent forms into a common species. As valuable as this attempt may be for wild plants, yet when applied to cultivated plants the tendency is to form groups too unwieldy for the purpose of those who would study into causes and effects of changed environments. For the successful study of plants of economic relation and great variability there is need of a precise system of nomenclature, and the only at present requisite is the absolute and ready delimitation of groups under a name system approved by botanists, and which shall not become perverted by popular use, as is the likelihood with vernacular names. In the present jejune condition of agricultural botany we may properly leave for future discussion those questions relating to genealogy, and be satisfied with a system that is accurate and convenient, and which shall enable us to record observations and results of study in a form available for use. I have hence sought for an improved nomenclature for maize, and the longer acquaintance I have had with my groups the more justified I am in my belief that in convenience and availability they leave but little to be desired.

From a botanical standpoint, I am disposed to accept *Zea tunicata* as a primitive form, from which are derived: *Zea everta*, the pop corns; *Zea indurata*, the flint corns; *Zea indentata*, the dent corns; *Zea amylacea*, the soft corns; *Zea saccharata*, the sweet corns; and *Zea amyleasaccharata*, the starchy-sweet corns.

Each one of five of these species furnishes three well defined sub-species, with parallel relationship throughout. Thus, sub-species A, the kernel broader than deep; sub-species B, the kernel as broad as deep; sub-species C, the kernel much deeper than broad. All my collections concur towards the belief that climatic relations are more evident in these sub-species than in the species themselves. With the possible exception of the dent corns and the starchy-sweet, for which but one locality is as yet known, the climatic range and adaptability seem about the same, but in the sub-species there is diversity, A being for climates of short season, C for long seasons, while B in general is intermediate, although a climate suitable for C can grow A and B. Sub-species A is the only kind represented in our more Northern collections of *Z. indurata* from Lake of the Woods, Northeastern Canada and North Dakota; of *Z. amylacea* from Manitoba; of *Z. indentata* from North Dakota; of *Z. saccharata* from Northern Maine and Northern Minnesota. Sub-species B comes from a little south of the before-mentioned range, and extending south especially throughout the elevated regions. Sub-species C is yet more southern, and rarely comes to me from regions of short season.

The number of varieties of Indian growing, or of Indian origin, which I have seen or collected, appear in the annexed table:

	Zea everta.	*Zea indurata.*	*Zea indentata.*	*Zea amylacea.*	*Zea saccharata.*	*Zea amyleasaccharata.*
Arizona cliff-dwellers (Nat. Mus.), Seen.				1		
Arizona Indian (From Dr. Vasey)				5		
Brazil Indian, San Paulo (From Prof. Derby)				2		
Cocopa Indian, Mexico (From Dr. Palmer)				3		
Dacota Indian, Fort Lincoln		1				
Guadalajara Indian, Mexico (From Dr. Palmer)				1		
Illinois Indian, Wyandotte				1		
Michigan Indian, Squaw				1		
New England Indian		4				
North Carolina Indian. Tuscarora in three colors				3		
Omaha Indian, Nebraska Black				1		
Peruvian. Mummy Cuzco				2		
San Padro Indian, Mexico (From Dr. Palmer)		1	7	4		3
Sioux Indian, Golden Sioux		1				
Susquehanna Indian. Eight-rowed sweet					1	
Tarahumarer Indian, Mexico (From Dr. Palmer)		2	1	5		
Tesuque, Pueblo, 1892, Seen.				6		
Yacqui Indian, Mexico (From Dr. Palmer)		1				
Zuni Indian, New Mexico (From Mr. Cushing)				6		
Totals	0	10	8	41	1	3

Dr. Edward Palmer, in a letter accompanying the Cocopa Indian corn, wrote that the same varieties were cultivated by the Mohave, Pima and Yuma Indians of the United States.

From my reading I think it is reasonably safe, although somewhat conjectural, to identify references to our species, as follows:

	Zea everta.	*Zea indurata.*	*Zea indentata.*	*Zea amylacea.*	*Zea saccharata.*
Canada Indian,		2			
Cliff-dwellers,	1		1	2	
Guaranies, of Paraguay,	2	1		1	
Honduras Indian,		1			
Mandan Indian,	1	1			
Mexican Indian,					1
New England Indian,		3			
Peruvian Indian,	2	4	1	6	1
Pueblo Indian,				3	
Virginian Indian,		1	1		
West Indian. Hispaniola,				1	
Totals,	6	13	3	13	2

The species described or mentioned by me in the Report of the New York Agricultural Experimental Station, 1884, with figures and diagrams of 126 varieties, are thus represented in tabular form:

	Sub-species A.	Sub-species B.	Sub-species C.	Totals.
Zea everta, Pop corns,	4	5	19	28
Zea indurata, Flint corns,	27	9	8	44
Zea indentata, Dent corns,	8	2	38	48
Zea amylacea, Soft corns,	7	5	2	14
Zea saccharata, Sweet corns,	14	12	8	34
Totals,	60	33	75	168

I have since received from Chili, one variety soft corn, subspecies B., and four varieties soft corn, sub-species C.

The regermination of cornseed, after drying, has a bearing on the question of the distribution of the seed in nature. Some trials in 1883 showed that sprouted seed air-dried for seven days, and then replanted, would renew growth. The per cent. germinating at the successive trials were as follows:

	Germination per cent., same seed, each trial.						Total days air-dried.
	I.	II.	III.	IV.	V.	VI.	
Flint varieties, . .	99	96	63	30	22	0	33
Dent " . .	80	78	14	21	0	0	24
Rice pop, ...	100	96	29	43	44	0	28

The comparative hardiness and prolificacy of our species, as determined under similar conditions of spacing and planting, is seen below.

	Varieties or Selections Tested.	No. of Seed Planted.	No. of Mature Plants Furnished.	No of Good Ears in Crop.
Zea everta, ...	15	712	625 or 88 per cent.	670 or 1.07 per plant.
Zea indurata, ...	11	504	373 or 74 " "	290 or 0.77 " "
Zea indenta, ...	20	1312	606 or 46 " "	409 or 0.67 " "
Zea amylacea (Tuscarora),	6	263	86 or 32 " "	134 or 1.55 " "
Zea saccharata, ...	27	1176	726 or 62 " "	756 or 1.04 " "
Zea tunicata (Dent form),	9	400	166 or 41 " "	105 or 0.63 " "

These results for prolificacy are not, however, strictly comparable, as prolificacy is determined largely by the spacing of the plants. Thus in a trial with Waushakum flint corn.

1 plant, per hill, the yield per plant, 3.5 good ears and 1.1 poor ears.
2 " " " " " " " 2.1 " " " 0.8 " "
3 " " " " " " " 1.5 " " " 0.4 " "
4 " " " " " " " 1.2 " " " 0.2 " "
5 " " " " " " " 1.0 " " " 0.2 " "

Most sorts of corn will germinate when quite unripe, in the milk or before hardening of the kernels has taken place. The more flinty the corn the earlier and more certainly does the germination occur. The order in my trials has been flint, sweet, dent.

As to distribution by countries my information is very incomplete. The varieties that are represented in my collections are as follows:

	Pop.	Flint.	Dent.	Soft.	Sweet.	Starchy-sweet.	Totals.
From Africa,	—	7	1	—	—	—	8
" Brazil,	2	3	1	2	—	—	8
" Chili,	—	—	—	6	—	—	6
" France,	4	5	2	2	1	—	14
" Peru,	—	—	—	2	—	—	2
" Mexican Indian,	—	4	8	13	—	3	28
" Venezuela,	—	—	2	—	—	—	—
" U. S. Indian,	—	6	—	17	1	—	24
" U. S. Cultivation, 1884, 1885,	13	46	45	4	43	—	151
Totals,	19	71	59	46	45	3	243

The hour at which first germination was noted at various temperatures, for each species, is given in the following table, the temperatures being the extremes during the trials:

	41°–43.7° F.	45.3°–50.7° F.	48.5°–58.5° F.
Zea everta.—Dwarf Golden,	498	228	141
White Pearl,	378	228	141
Amber Rice,	378	228	141
Zea indurata.—Waushakum,	331	228	142
Eight-rowed White,	331	216	150
Zea indentata.—Adam's Early,	233	180	142
Chester Co. Mammoth,	233	168	142
Zea amylacea.—Tuscarora,	378	228	161
Zuni Blue,	431	228	185
Zea saccharata.—Stowell's Evergreen,	452	288	195
Narragansett,	498	300	209

II.

Zea everta, the Pop Corns. N. Y. Ex. Sta. 1884, 183; 1882, 59, *fig.*

The kernel split laterally shows the chit and corneous matter enveloping. In some cases a fine starchy line. The small size of the kernel and the property of "popping" makes identification certain.

Zea curagua Molin. Bonafous, Mais, 1836, 29. (A pearl pop.)
Zea Mays Lam. Ill. 1823, *t.* 749, *fig. f.* (A twelve-rowed pop.)
Zea hirta Bonaf. l. c. *t.* 4. (A pearl pop).
Zea rostrata Bonaf. l. c. 32. (A rice pop.)
Zea Mays præcox Bonaf. l. c. (A golden pop.)
Zea Mays minima Bonaf. l. c. (A dwarf-golden pop).
Zea canina Wats. Proc. Am. Acad. **26**: 161. (A rice pop.)

The common eight-rowed pop seems to have no history, although probably in cultivation in New England from early times. It belongs to sub-species A. The plants frequently bear several ears to a stalk and are subject to monstrous growth. The twelve-rowed, a representative of sub-species B, also seems to have no history. Under the name of small white, Salisbury, 1848, says it bears from three to seven ears to a stalk. A lemon-yellow form is the milho pepoca, of Brazil. Sub-species C has the largest representation. It comprises the mais quarantino of France, at least in the samples I have received, and the mais nain, mais a poulet of the French; the cinquanto, sessantino and torquetto of Italy, probably. In Mexico, under mais cuarentano, Heller gives Mexican names of varieties as mais tremes and olote colorado. The golden pop group are distinguished by small size of ear and kernel and extreme earliness. Hence we may mention here, without certainty as to the species, early maturing varieties. Humboldt quotes Oviedo as having seen in Nicarauga a variety ripening in 30 or 40 days, says that he remembers finding this variety on the banks of the Amazon, and that in Hungary there is a two months' variety. Dalechamp, 1587, refers to a variety that matures in two months, and another less grown which ripens in 40 days. Porta, in his Villæ, 1592, refers to a six weeks' and two months' corn. Lery, in his Brazil, 1594, names a 45 day corn. Morison, 1699, describes from America the "Rathripe" corn. Dobrezhoffer, 1749, mentions in Paraguay, the abati miri, which ripens in a month, but has very small dwarfish grains. Catlin describes finding among the Mandan Indians an early corn with ears as long as a man's thumb. Nuttall calls this *Zea Mays præcox*, a name which Bonafous repeats for a golden pop variety. The corn of Lake Titicaca, described by Squier as dwarf and hard grained, is almost certainly a pop. The golden pop varieties when grown in pots usually develop tassel corn in my experience. Hence we note here that Parkinson, 1640, describes the Frumentum indicum alterum minus, as grown in the unfavoring English climate, as not bearing crop "at the joynts of the stalkes as the other, but at the toppes following the flowers." This variety was not known to Ray, 1688, and he doubts the description and classes with Frumentum indicum mays dictum minus, C. Bauhin, 1623. The pearl pop group is distinguished by the dense aggregation of the kernels and their nacre-like lustre. Molina calls it the stone maize. Samples from Rio Claro, Brazil, were labeled milho perola. In California I have seen on exhibition stalks bearing up to nine ears. The Mapledale Prolific, which seems to belong here, is figured by a seedsman in 1890, with sixteen ears on a stalk, some of the ears clustered two in an axil; an affidavit accompanying says that 10 stalks had 121 ears, and one stalk 19 ears. The rice pops are peculiar for their pointed kernels, and the tendency to yield cone-form ears with imbricated kernels. They seem ancient in Peru, as having been found in sculpture. Rivers and Tschudi say that the rice pop kind and cone-shaped ears were considered as sacred things and were buried with mummies by the Peruvians. Dobrezhoffer, 1749, says that in Paraguay the kind with pointed kernels was called bisingallo. A noticeable feature of the rice pop is the tendency to sport. Frequently half the ears of a garden crop will be flattened or digitate at their apex, and in the Bear's Foot variety this tendency has become permanent to form a flat ear. There is also a tendency in the plant to form branches, or to bear aggregate ears, or to develop tassel corn, and occasionally tassel ears. The Monarch White Rice, as advertised in 1887, is figured as bearing tassel ears and also seven ears on a stalk. When grown separately the plants usually sucker greatly. The description of the kernels of *Zea canina* Wats. as "small, white, hard and smooth, ovate, acutish, constricted at base," would apply to this class, but the "ears small, 4 to 12-rowed," offer a variety not yet known to me. His other characters, except as to the spikelets and glumes which I have not looked for, do not differ from characters to be observed in all our species as of frequent or exceptional occurrence, and especially in *Zea tunicata*. The few kernels in the herbarium specimens of *Zea canina*, presented me by Professor Watson, are distinctly of the rice pop type, and a peculiarity overlooked by Professor Watson, or more likely not present in the ears that underwent his examination, some are podded. If we reason closely from this statement, we may class *Zea canina* Wats. with my *Zea everta*, with the appearance of *Zea tunicata* as an atavism. The *Mais roscro*, a pop corn observed by Professor Duges as cultivated in the region (Mexico) where *Zea canina* was collected, we only know by name.

[illegible]

Some varieties of sorghum seed, such as "rice wheat," have the property of popping like pop-corn; so also the seeds of *Amarantus leucospermus* Wats., and are thus used in Mexico.

III.

Zea indurata, the flint corns, N. Y. Ex. Sta. 1884, 164: 1886, 59, *fig.*

The split kernel exhibits the chit, starchy matter, and a corneous matter enveloping. It cannot be confounded with any other species except the pop, from which it is distinguished by the larger kernel and inability to "pop."

Mays Zea Gærtn. Fr. 1788, *t. 1.;* also same figures, *Mays* Tourn. Inst. 1719. *t. 305: Zea Mays*, Lam. Ill. 1823, *t. 749, fig. h.*

Turcicum frumentum Fuchs. Hist. 1542, 825 and as copies, Fuchs, Hist. 1549, 783; 1551, 783; imag. 1545, 476; pl. effig. 1549, 476; *Milium indicum*, Dod. frugum. 1552, 35; post, 1554, 10; *Frumentum turcicum*, Lyte's Dod. 1578, 464; *Triticum Indicum Fuchsii*, Lugd. 1587, 382; *Triticum Indicum*, J. Bauh. 1650, 2, 453; *Triticum turcicum* vel *indianum*, Chabr. 1666, 174; 1673, 174.

Frumentum turcicum Blackw. herb. 1773, *t. 547*.

I find no synonyms for our vernacular "flint corn." It is the Indian corn, in yellow, red and blue or blue-mixed varieties found by the Pilgrims as mentioned by Mouart and Higginson; the Indian wheat, yellow, red and blue of Josselyn. Cartier, 1535, found two varieties in or near the present Montreal, one called offici, as big as small peas, and hence probably our Canada Twelve-rowed; the other called carracony, as great and somewhat bigger than small peason, hence the Canada Eight-rowed. Heriot, 1588, in Virginia, under the name pagatour seems to describe a flint corn. This species is probably the Mays minor, with yellow, red and blue colors, which ripens in England in four months, as recorded in Miller's dictionary, editions of 1731, 1748 and 1752; the Zea vulgare, caule humiliore, etc., of the edition of 1771, the ears 4 to 5 inches long, the kernels yellowish white, deep yellow, purple, blue and mixed, ripening in England. The Mandan Indian corn, as described by Salisbury, seems to be a flint, and a flint corn under the name of Mandan has come to me from Fort

Lincoln, Dakota.* Du Pratz, 1763, describes white, yellow, red and blue homony corn in Louisiana. The San Padro Indians of Mexico cultivate a flint variety, the Tarahumarer Indians two varieties and the Yacqui Indians one, as represented in my collections. The common corn of Honduras is described by Squier as a flint. In Guatemala, Brigham found a variety of large kernelled corn like "rice corn," a form which I have never seen. In Paraguay the Guaranies have an abati hata, 'composed of very hard grains.' In Peru, DeVega says the Indians have a hard kind called muruchu. Tschudi seems to describe a flint corn under the name morocha, and Herndon and Gibbon describe the mais morocha at Tarma as with small grain, red, white, yellow and blue, which is parched, forming cancha or "toasted maize." The Topover corn, a very distinct and peculiar variety, with eight or ten rows, was claimed to have originated in Nantucket, and was first brought to notice in 1884. In 1886, I found a yellow and a white Ten-rowed Topover in the Tarahamarer Indian collection sent me by Dr. Palmer.

I have noticed more sports in this species than in the others, because it is the one I have cultivated in my farming. I have figured in the *Scientific Farmer*, October, 1878, a tassel bearing grain, a tassel undergoing partial transformation into ear, and one converted into a tassel ear; also four ears developed in a bunch from the upper node. Mention is also made of the extremity of an ear bearing a tassel, and in the New York Experiment Station Report, 1883, 40, of an ear of New England twelve-rowed, eight inches long, then one and a quarter inches of tassel, and at the end of this tassel another well formed ear three inches long. In other varieties, a branch may occur on the leaf axil bearing a terminal ear and one or more at the nodes below, and in 1879 I had a branch with one terminal and three nodal ears. By compressing the pith of a growing plant this branching may be greatly stimulated. One variety, the Vermont yellow, is described as bearing its ear normally on a branch two feet long. Occasionally two ears, more rarely a bunch of ears appear at a node, but in such cases they all do not fertilize. Digitate and branching ears are not very uncommon. In some cases two ears joined at their base, in others three or more; more rarely a whole group is so joined as to form a cup lined both inside and outside with kernels. In eight-rowed varieties four-rowed ears are sometimes found, the ear then flattened and distichous. Six-rowed ears are also found, and such have a tendency to develop the rows in a spiral. In eight-rowed corn the breaking of the cob discloses a four-sided appearance; in the ten-rowed, a five-sided appearance, and so on, as I have indicated in my diagrams published in the New York Experiment Station Report for 1884. Suckering is of frequent occurrence, and is greatly stimulated by an open exposure and a highly manured soil. Japanese striped is an excessively suckering variety. In a digitate ear of Waushakum corn I once found some podded kernels, and also once in an otherwise normal ear of eight-rowed New England.

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* May 14, 1894, Dr. Wm. Saunders, Director of the Experimental Farm, Canada, sent me a sample of the Squaw corn grown at Rat Portage, Lake of the Woods, about 50° N., which corresponds with the Mandan flint, and is a shorter and smaller ear of the common Northern New England Eight-rowed. The ear was 6½ inches long and kernels large.

The Sorghum varieties "Dhoura," "African wheat" and "Millo maize" have a structure of kernel corresponding to the flint corn type.

IV.

Zea indentata, the Dent corns, N. Y. Ex. Sta. 1884, 172; 1886, 59, *fig.*

The split kernel exposes the chit, corneous matter at the sides, the starchy matter extending to the summit.

Turcicum frumentum Dod. frum. 1566, 74, and also as copies; *Milium Indicum* Lob. obs. 1576, 24; *Frumentum turcicum* Dod. pempt. 1583, 500; 1616, 509. *Milium Indicum Plinianum* Lob. ic. 1591, 39; *Frumentum Asiaticum* Ger. 1636, 81; *Milium Indicum maximum*, Park. th. 1640, 1138; *Triticum Peruvianum album longum III*, J. Bauh. 1650, 2, 454; *Triticum Peruvianum* Chabr. 1666, 174; 1677, 174.

Frumentum indicum granis luteis Weinm. phyt. 1739, *t. 518.*

Frumentum seu milium indicum granis rubentibus Weinm. l. c.

I find no vernacular names for this species other than "dent" in America. A soft corn, through rapid drying, may form a crease or a dent in its kernel, but a split kernel, which at once shows absence of corneous matter, determines the species. The dent corns furnish the bulk of our commercial supply for home use and export. The varieties grown for this purpose belong almost exclusively to sub-species C., and often have very many rows, even to the number of forty-eight. The poketawes or hokotawes of the Powhattan Indians, 1608, was a horse-tooth dent. The most northern locality represented in my collection is North Dakota, an eight-rowed form, sub-species A. The amarillo of Peru, as described by Tschudi, I take to be a dent. In a Chilian collection kernels with corneous sides and sweet at summit indicate the presence of dent corn in that country. The *milho catete vermelho*, of Brazil, is a dent.

The Early Adams is a variety in which the irregularity of the kernel arrangement is characteristic. The Extra Early Adams, sub-species C., is reported as ripening at Ottawa, Canada. One variety grows from African flint seed, through atavism, had kernels armed with a short, sharp, stiff spine where the silk was attached, but this peculiarity was not reproduced in the growing. A red-husked dent is sold by our seedsman, and from Dr. Palmer, in 1886, I received two red-husked varieties among seven dents collected from the San Padro Indians of Mexico. Some varieties are described as bearing many ears to a stalk, seven to eight in the Baden, six to eight for Blount's Prolific. I have seen as many as nine good ears on a stalk of this variety. These varieties are also much subject to suckering, as seems also the Chinese tree-corn, which is described as branching. The formation of adventitious roots is very noticeable in this species, although not confined to the dent group. There is also a strong tendency in the dent for the ears to hang downward at maturity, thus protecting the kernels from the weather. From Dr. Palmer I received from the San Padro Indians one sample, five almost bunched ears, the terminal one about five inches long and kernel-bearing, and within a space of three inches below were four alternating unfruitful ears. As will appear elsewhere, we have noted the appearance of podded ears on the normal *Zea tunicata*, in a crop of Blount's Prolific.

In the variety of Sorghum called "Neeazana" we have a structure of kernel similar to the dent corn.

V.

Zea amylacea, the soft corns, N. Y. Ex. Sta. 1884, 181; 1886, 59, *fig.*

The split kernel shows only the chit and starchy matter, corneous matter being entirely absent.

Zea erythrolepsis Bonafous, mais, 1836, 30 (Tuscarora).

Zea macrocarpa Klotz. Bot. Zeit. 1851.

Maizium, Peter Martyr, 1493, in Eden's Hist., Trav. 1577, 10.

Frumentum turcicum Dod. frugum, 1552, 35; Lyte's Dod. 1575, 464. The same figures, *Triticum indicum*, J. Bauh, 1650, 2, 453.

Frumentum Indicum Matth. comm. 1570, 305; Calceol. 1571, 164; the same figure, *Triticum indicum* Matthioli, Lugd. 1587, 1: 382.

Frumentum Indicum Cam. epit. 1586, 181. The same figure also in Uffenb, 1609, 398; Becher, 1662, 147; Verzasch, 1678, 172; Zwing, 1696, 323.

In my collections this species shows a greater variety of shades and colors than any of the others, and is the principal sort grown by the Indians of Mexico. Hence we can refer to Hernandez, who in his history, 1651, mentions white, pale, black, purple, yellow, blue and mixed colors; also a very long ear with glistening white, large and tender seed, as Mexican varieties. His figure under Tlaolli seu maizio, p. 242, is the same as *Aliud milium indicum magnum* Lob. ic. 1591, 40, and *Frumentum turcicum* Ger. 1636, 81. His Tlaolli seu maizio, p. 243, is the same figure as Milium indicum rubrum, Lob. ic. 1591, 40, and Frumentum indicum luteum, Ger. 1636, 82. Tabernæmontanus in his history, editions of 1588 and 1613, and Icones, 1590, figures under *Frumentum turcicum* five varieties which may be flint; under *Frumentum indicnm* fourteen varieties, black, purple, blue, red, yellow, white, mottled, variegated and many-colored, and the figures suggest a soft corn. The same figures appear in Gerarde's herbal, 1597, but the names badly transposed or different. *Frumentum Indicum* Tabern. 1588, 760, 761; 1613, 641; ic. 1590, 265, is copied in Bauhins' editions of Matthiolus, 1598, 319 and 1674, 319; in Gerarde, 1597, 75, called *Frumentum Asiaticum*; in the second edition of Gerarde, 1636, 75, it is called *Frumentum Indi-*

cum cæruleum; in Bauhins' theatre, 1658, 459, *Frumentum indicum mays dictum alterum;* and an apparent copy in Morrison oxon. 1699, s. 8, *t. 13, f. 1*, is labelled *Frumentum indicum mays dictum.* Peter Martyr, in his first decade, written in 1493, describes the maizium of Hispaniola as a black, pea-size grain, which when broken is "whiter then snowe," and hence a soft corn. De Vega, in his Royal Commentaries, says the ancient Peruvians had a sort called capia, "tender and highly esteemed." The mummy corns that I have seen from Peru have been soft corns. Dobrezhoffer says the Guaranies of Paraguay had an abati moroti, which consists of very soft and white grains. The maize found by Darwin imbedded with shells and rubbish on a terrace 85 feet above the beach in Peru, he declares identical with the kind found in the Peruvian huacas. In the Tusayan pueblo (New Mexican) flute ceremonial legend, as given by Matilda Coxe Stevenson, occurs the following passage: "He then placed a yellow ear of corn to the north of the bowl, a blue ear to the west, a red ear to the south, and a white to the east; a black for the zenith was placed by the side of the yellow ear, and the all-color for the nadir by the side of the red ear." In these colors we seem to recognize soft corn, especially as in the Zuni collection of soft corn we have these colors, and the same varieties in the same color I have seen in soft corn brought to Santa Fé by tourists from the Tesuque pueblo, nine miles distant. Du Pratz, in his history of Louisiana, 1763, mentions as a variety "flour maiz, which is white, with a flat and shrivelled surface, and is the softest of all kinds."

The soft corns have a wide distribution, and seem to have been popular with Indians, as the kernels are readily broken down into flour. I have recognized it from Manitoba in the North; in specimens from the cliff dwellings and as in cultivation in eleven varieties by the Southwestern tribes; in the Omaha corn of Nebraska; the Squaw corn of Michigan; the Wyandotte of Illinois; in the Tuscarora in three colors from North Carolina; in Mexican Indian corn in thirteen varieties; in the maizium described for the West Indies; in two varieties described in Peru; in the mummy corn of Peru; in five varieties from Chili, including the Cuzco. This latter is the largest kerneled corn known, some collections showing kernels an inch long, correspondingly broad and thick. It is described as having many varieties, and five colors are named by Markham.

But few sports have come under my observation. In 1885 an ear of Zuni yellow was grown with a tassel protruding from the apex. The Wyandotte suckers so freely as to be said to tiller like wheat; it also bears many ears to a stalk; one sample from the San Padro Indians had a branch with one terminal ear, and four ears bunched a short distance below.

The variety of Sorghum called "Chinese sugar cane" has seed floury throughout and without corneous matter, like the soft corns.

VI.

Zea saccharata, the sweet corns. N. Y. Exp. Sta., 1884, 156; 1886, 59, *fig.*

The kernel of this species has a semi-transparent or translucent, horny appearance, and is more or less crinkled, wrinkled or shrivelled.

Zea mays rugosa Bonafous, Mais. 1836, *t. 11.* (An eight-rowed sweet.)

The earliest reference to sweet corn that I find is in the Zuni myth, as given by Cushing, quoted by Harshberger, where it is said that the oldest sister was yellow corn; the second, blue; the third, red; the fourth, white; the fifth, speckled; the sixth, black; the seventh, sweet corn. The six colors were in the Zuni collection sent me by Mr. Cushing, but there was not a sweet corn among them. The first sweet corn in American cultivation was the papoon corn, an eight-rowed variety with a reddish cob, first introduced to the region about Plymouth from the Indians of the Susquehanna in 1779. It belonged to sub-species A. Tschudi, who was in Peru 1839–42, describes a sweet corn apparently of sub-species C., under the name *Amarillo de chancay.* The Black Mexican was described by Burr in 1863, its name indicating origin. Under this name two varieties are now grown, one of sub-species A, the other of sub-species B.

The distribution into culture was slow. It was not mentioned by Jefferson in his notes on Virginia in 1781, nor by writers on

American gardening in 1806, 1817, 1818, 1819, 1821 and 1828; nor by Seringe for Switzerland in 1818; nor by Metzger for Germany in 1824; nor by Noisette for France in 1829. Bridgeman mentions one variety in 1832, as does Buist in 1851. The original eight-rowed form, and another like it, but with a white cob, is mentioned in 1853; in the Patent Office Report, 1853, the Mammoth Sweet and Stowell's Late Green are named. Schenck, 1854, knew two varieties; Klippart, 1858, six varieties; Burr, 1866, twelve varieties. In the New York Station Report, 1884, I described and figured thirty-three varieties. One variety, the Ruby Sweet, of recent introduction, has red husks.

Sweet corn kernels are usually all corneous; sometimes, however, a small quantity of starchy matter is visible. I suspect that a fuller study may unite the sweet corns as variety forms of pops, flints and dents. In the New York Station Report, 1884, 131, mention is made of some kernels flint on the chit face and sweet on the opposite face. Then, again, in my Chilian collection were some kernels corneous at the sides and sweet on the summit. My *Zea amyleasaccharata* may perhaps be also mentioned as a form of variation. I have observed but few monstrous growths. I once received a plant of Stowell's Evergreen but 12½ inches tall, well formed, of vigorous green, leafy, and bearing three unripe ears, two of which were kernelled. These two ears were hermaphrodite, the ovule and stamens within the same glume. We have also record of podded kernels being found in a crop of this species.

VII.

Zea amyleasaccharata, the starchy-sweet corns. N. Y. Ex. Sta. 1886, 60, *fig.*

This species is founded upon three varieties found in the San Padro Indian collection of Dr. Palmer and sent me in 1886. The external appearance of the kernel is that of a sweet, but examination shows that the lower half of the kernel is starchy, the upper half horny and translucent. These varieties had all a white cob, the kernels deeper than broad, or sub-species C.

1. Ear fusiform, kernels rounding towards a small stalk, 7 inches long by 1¾ inches in diameter at largest part, 16-rowed.

Kernels translucent yellow, flat at summit, deeply shrunken at top and sides, no sulcus between rows. The most attractive sweet corn I have ever seen.

2. Ear fusiform, rather pointing at tip, kernels rounding strongly towards a smallish stalk, 5 inches long by 1⅞ inches in largest diameter, 18-rowed, kernels much deeper than broad, very thick, wrinkled, of a translucent yellow. No sulcus between rows.

3. Ear slightly fusiform, kernels rounding gradually to a small stalk, 5 inches long by 1¾ inches in largest diameter, 16-rowed. Kernels translucent yellow, quite golden, wrinkled. A deep sulcus between the rows.

The crop failed to mature at Geneva, N. Y., and thus the seed was lost. The plants grew very tall, and were only at the bloom when fall frosts came.

VIII.

Zea tunicata, the Pod corns.

In this species each kernel is enclosed in a pod or husk, and the ear thus formed itself enclosed in a husk.

Zea mays tunicata St. Hil. Ann. Sc. Nat. **16**: 143, fide DeCand.

Zea cryptosperma Bonafous, Mais. 1836, *t. 5*.

Zea mays vaginata, N. Y. Ex. Sta. 1884, 186, *fig.*

Frumentum indicum grano avellano magnitudine, C. Bauh, 1623, 24; J. Bauh, 1650, 2, 454; Moris, Oxon. 1699, 3, 248.

Frumentum indicum majus grano avellanæ, C. B., J. B., Moris, Oxon. 1699, 3, s. 8, *t. 13, f. 2.*

Æthiop Manigette, Mentz. Index, 1682, 122.

The vernacular names I have noticed are: California corn, Cow corn, Forage corn, Husk corn, Oregon corn, Pod corn, Primitive corn, Rocky Mountain corn, Texan corn, Wild corn. In Africa, manigette (C. B., 1623); in Buenos Ayres, pinsingallo (Bonafous).

The Bibliography of this species, additional to that given in the list of synonyms, is as follows: Teschemacher, Proc. Boston, Soc. of Nat. Hist. Oct. 19, 1842; Lindley, Jour. Hort. Soc. 1846, 115, *fig.*; Salisbury, Trans. N. Y. Agr. Soc. 1848, 837; U. S. Pat. Office Report, 1853, 98, *fig.*; DeCandolle, Geog. Bot. 1855, 951; Orig. des Pl. Cult. 1883, 316; Klippart, Agr. of Ohio, 1858, 24,

fig.; Darwin, An. & Pl. under Domes [1868] 1, 386; Carman, Moore's *Rural New Yorker*, Mar. 3, 1877, *fig.*; Sturtevant, Trans. N. Y. Ag. Soc. 1879, 37 and reprints or excepts, 1879, 21; 1880, 21; N. Y. Ex. Sta. Reports, 1882, 54; 1883, 40; 1884, 142, 186, *figs.*; 1885, 95; 1886, 64; Science, 1883, 1: 234; Wittmack, ueber anteken mais, etc., in Berlin, Anthrop. Ges. Nov. 10, 1879; Landreth Seed Catalogue, 1889, *fig.*

DeCandolle, who investigated its history up to 1835, quotes the Abbe Larranhaga as saying that the Guaycurus Indians cultivate it, but according to St. Hilaire this tribe is not agricultural. A young Guarany, who recognized this maize, said that it grew in the humid forests of his country. Bonafous received the seed from Buenos Ayres under the name pinsingallo. Lindley received seed from New York said to have come from the Rocky Mountains. C. Bauhin, 1623, gives an African name, manigette. The seed is occasionally supplied by our seedsmen as a curiosity for growing in the garden, and doubtless the names California corn, Oregon corn, Rocky Mountain corn and Texan corn indicate sources from which seed have been procured, but without necessarily implying origin. It is very rarely grown even by the curious, and but few farmers have seen it. A Mr. Bullard, of Ohio, on seeing some specimens for the first time, expressed surprise at the ear, but said he had frequently found single kernels podded in his crop of dent corn. May 18, 1884, J. W. Nicholson, Camden, N. J., wrote me that he had now planted Blount's Prolific [dent] corn, the original seed from the Department of Agriculture at Washington for four years, and that each successive year he had found more and more pod corn in his crop. The samples he sent me were ears of fully podded corn of the Blount's Prolific type. December 9, 1885, I received a number of ears of a podded flint corn from Ohio, and one of these ears had kernels twinned in the pods. In the specimens of *Zea canina* sent me by Professor Watson, I note kernels of podded corn of the rice pop type. In *Science*, 1894, 109, is an account of "an ear each grain of which had a distinct shuck" from a planting of "ordinary sugar corn." I have myself found podded kernels on a digitate ear of Waushakum flint, and also on an otherwise normal ear of a common New England eight-rowed flint, and have raised podded sweet kernels from a white dent ear raised from a red unpodded ear of pod corn. From yellow dent seed, sub-species C, were grown sweet, flint and dent corns with the podded character, and sweet, flint, dent and soft corn in unpodded ears. The variables noticed were tassel corn, ears with kernels uniformily and lightly husked, heavily husked, fastigiate ears, unpodded ears, cone-shaped ears, cylindrical ears; kernels white, yellow, red and striped. From podded seed, 166 plants yielded 76 podded and 29 unpodded ears and one tassel ear. The presence of smut diminished the yield to a large extent. The number of rows on unpodded ears varied from 12 to 24.

The description of the dent plants bearing the podded ears is: Strong growing, ordinarily from 8 to 10 feet tall, exceedingly leafy, inclined to sucker, adventitious roots at lower nodes, the crop borne about four feet from the ground, on the fifth to seventh node from the top. Tassel very heavy, the branches long and drooping, not rising very high above the foliage, very frequently kernel bearing, the grain either bare or podded. Ears variable in length and form. In the heavily podded samples the cone shape with imbrication is prevalent; as the podding becomes lighter the ears tend more towards the cylindrical, but even in wholly unpodded ears the cone-shape occasionally persists. In some cases a fastigiate group of husked ears at the but, changing to heavily podded kernels as we near the tip; in other cases the outer husk embraces a whole cluster of ears, which in our growing were too late for crop. Cobs in the heavily podded ears very flimsy, when dry tending to break readily into short pieces; in the fastigiate specimens even more flimsy; in the lightly podded forms larger and less loose, even to the ordinary hard and dense cob of the common form. Kernels in heavily podded samples, being removed from pressure, are more rounded than in their unpodded form, and often distinctly pointed towards the place of insertion on their cob, the distichous arrangement often very pronounced; occasionally two or even three kernels in a common pod. The corneous matter is very hard and flinty. The pods are variable in length, usually white, occasionally brown or red-tinged.

In favor of *Zea tunicata* being closely allied to a primitive form we may call attention to the appearance of podded kernels on ears of our other species, as recorded here for pops, flints, dents and sweets, which suggests atavism; to the flimsiness of the cob and its occasional readiness to disarticulate; to the tendency towards fasciation or clustering in the ears; to the hardness of the corneous matter in the kernels; to the protective character of the pods as against insect and bird depredation, as favoring distribution of the seed under natural agencies, as favoring germination, through retention of moisture of seed dropped on the surface of the ground, as protective against weevil infection. It is almost certain, says Darwin, that the aboriginal form would have had its grains thus protected.

As a wild plant this species has been insufficiently recorded from Paraguay, and also in the form of *Zea canina* from Mexico. Heller writes: "We often find in Mexico single plants of maize which grow self-sown, and flourish without culture; and though they may stand miles from any inhabited place, they cannot be considered wild, as, notwithstanding the often monstrous variety, they always bear the characteristics of cultivated maize." Professor Watson quotes Professor Brewer's letter to me, in which he says that a well-known German collector, a Mr. Roezl, told him in 1869 that "he found in the State of Guerro a *Zea* which he thought specifically distinct and undescribed, the ears very small, in two rows, truly distichous, the ear (but not each grain separately) covered with a husk, the grain precisely like some varieties of maize, only smaller and harder." Professor Watson thinks this probably the same as his *Zea canina.* Professor Duges, in sending this mais de coyote to Professor Watson, mentions that "a pop corn, mais rosero," is cultivated in the same region, a fact of some significance.

We hence are inclined to believe that when a truly wild *Zea* is discovered it will be of a podded form, the kernels small and very flinty. It will be recalled that in our trial of vegetations pop corn seed held the supremacy, and that pop corns showed the strongest vitality in regerminations after air-drying.

IX.

When we consider the number and the perfection of the varieties of maize, we cannot but recognize that a long antiquity and extended cultivation were requisite for their differentiation. For various reasons I am disposed to consider *Zea everta*, of our cultivated species, the nearest to the primitive form, and *Zea amylacea* as the furthest remove from the primitive form; the Cuzco corn of Peru and Chili the most improved class of variety. The next most highly developed varieties seem to be the horse-tooth softs of Chili. The largest number of species represented in any one Indian collection is four, in fifteen varieties, from the San Padro Indians of Mexico, seventeen ears which excelled in perfection of form any like number collected from any one locality or from seedsmen. The next largest number of species is the three, in eight varieties, from the Tarahumarer Indians of Mexico, "the timid Tarahumari," as Harshberger quotes, "a savage race, living mostly on the cliffs, and planting a little corn without cultivation on the steep hillsides, and not otherwise tillers of the soil." It is unfortunate that our collections from South America are so limited, as Peru excels in species and varieties noted in the table gleaned from our readings.

If we look upon agriculture as a pursuit which yields a food supply requisite for the maintenance of a population, then the American Indian was an agriculturist wherever with suitable climate tribal strength or location availed to protect his crops. When Gen. Sullivan, in 1779, made his invasion into the Indian country of Central New York, the Indians were subdued through the destruction of their food supplies rather than through their losses in battle. In perusing the journals of this expedition we find continual mention of the seizure of corn, of large fields, of abundance of corn, and at the present Genesee the destruction of 20,000 bushels. In the earlier invasion of this region by De Nouville, in 1687, some 1,200,000 bushels of corn are said to have been destroyed, and in 1696 Frontenac, in the country of the Onondagas, employed his army for three August days in destroying the growing corn, which extended from a league and a half to two leagues from the fort. In the Pequot war, in 1636, the English destroyed 200 acres of corn on Block Island, R. I., alone; and in the King Philip war, in 1675, the Puritans harvested a thousand acres as spoils.

When Cartier reached Hochelega, the present Montreal, in

1535, he found the town surrounded by extensive cornfields. In 1605 Champlain mentions fields of corn at the mouth of the Kennebec river and along Cape Cod. In 1609 Hudson found "a great quantity of maize" among the Indians of the river of his name. The Pilgrims, in 1620, found "fifty acres" of field in one place, and "new stubble" elsewhere in their early reconnoisance of their country. In 1634 John Oldham bought 500 bushels of the Narragansett Indians, who had promised him a thousand. In 1747 Cobden says the Five Nations made planting of corn their business and supplied more northern tribes, and in 1794 Gen. Wayne wrote of the Delawares, of Ohio, "nor have I ever before beheld such immense fields of corn."

In the early settlement of America every European colony seems to have been dependent upon corn bought or seized from the Indians, and every march of invasion was rendered possible by the corn found in the Indian granaries or taken from the growing plants. De Soto's march from the east discloses corn in crops throughout his course, as did Coronado's march from Mexico to Kansas, wherever climatic conditions permitted.

Columbus found maize in the West Indies on his first voyage, in 1492. In 1498 he reports his brother passing through eighteen miles of cornfields on the Isthmus, and the same year he found maize in Venezuela. At Zobabra, 1503, Diego Bartholemew saw above six leagues of cultivated corn. Cornfields and corn are also mentioned in Central America by Pascual de Andagoya in 1516. In 1518 de Encica mentions maize and roots as constituting the food of the Amazons, and in 1520 the ships of Magellan were supplied with maize at Rio Janeiro. Cieza de Leon, who travelled in Peru, 1532–50, continually speaks of fields of maize, as do more modern travellers, and the remains of irrigation conduits attest the antiquity and extent of its culture. Thevet, 1558, describes maize in Brazil, as does Lery, 1594, and Nieuhoff in 1647. In Chili maize was the ordinary diet, as Alonzo de Ovalle wrote in 1649. In Mexico the sixth and seventh centuries of our era represent the Toltec period, and the Olmecs are thought to have raised maize before the time of the Toltecs.

The antiquarian evidence is the finding of charred corn and cobs in Indian mounds in Ohio, Missouri and elsewhere, and in the ears and grains found enclosed with the mummy burials in Arizona, New Mexico and Southern Utah. Charnay reports representation of ears of maize on some ancient statuary in Mexico. Brocklehurst figures the vase of Centeotl with its ear of corn, and hieroglyphics on the monuments at Palenque indicate that maize was an important food in Yucatan. The Smithsonian Institute has an ear of corn found in an earthen vessel eleven feet under ground in a mummy grave near Arequipe in Peru. Tschudi describes two kinds taken from tombs apparently prior to the dynasty of the Incas. Squier found not only the grain, but an ear carved out of a variegated talc within a mummy covering at Pachacamac, where also spikes of maize were observed by Pickering. A harvest vase of maize from the ruins of Chemu, near the present Truxillo, shows the heads of children peeping out among the corn cobs, as Markham writes. In 1835 Darwin found on the coast of Peru heads of maize together with eighteen species of recent sea-shells embedded in a beach which had been upraised at least eighty-five feet above the level of the sea, and these relics he pronounced identical with those taken from old Peruvian tombs. At Tarapaca, in 1874, beneath the volcanic formation called Chuco, were found cobs of maize buried with a mummy.

In what locality did the cultivation of maize originate. Our data is as yet too imperfect for reply, as we have little record of the varieties that are at present grown either in Peru or Mexico, between which places our choice seemingly is to be made. The evidence of the more ancient presence of maize in Peru in the finding of specimens in geological deposits is superior to that tabulated for Mexico. The finding of a wild corn (probably an escape) in Mexico, is a little more certain than the Indian testimony of wild corn in Paraguay. The superior development of varieties, as the Cuzco of Peru, and the Cuzco and horse-tooth soft forms of Chili, is strong evidence in favor of a South American origin. The rice pop found in Peruvian sepulture, and as growing in Paraguay, is also in evidence; but the rice pop form is present in *Zea canina* of Mexico.

The antiquity of the culture must be great as measured by years, for Darwin's variety from a geological deposit was pronounced identical with that buried with the ancient Peruvians, and this corn, so far as we have seen it, is *Zea amylacea*, the most divergent of our species from the primitive form; but *Zea everta*, rice form, is the least divergent and is also found among the relics of the tombs. So the indefinitiveness of mention, even by such an eminent observer as Darwin, leaves uncertainty.

X.

The environmental relationships of maize seem to have been but little studied, and are very obscure. Seed sown on the surface, through the property of regermination, will frequently vegetate, as will also seed sown at a depth of eight inches or more. When the seed is planted in ground of a low temperature, although the germination process will go on at 42° or 43° F., yet the progress is so slow that mould often destroys vitality before vegetation can occur, while at a high temperature progress is so rapid that this danger is escaped. In the *Scientific Farmer*, October, 1878, I called attention to the embryo ears on a cornstalk, and gave a figure. These embryo ears usually all but one remain dormant when the crop is close planted, but are inclined to develop as openness of planting increases. By mutilating the plant in various ways these dormant ears may be stimulated into development, the lower ones especially, into branches with a terminal ear. Compressing the upper portion of the stalk is often followed by kernel formations on the tassels, and a ligature applied to an ear has been followed by the development of a tassel on the extremity. Suckering in the corn plant is the development of dormant buds, and is furthered greatly by openness of planting and fertility of soil, although in some varieties, like the Wyandotte soft and the Japanese striped flint, it becomes a characteristic which can scarcely be checked. The relation of the plant to climate is difficult to define. The influences often ascribed to climate seem usually to be the result of a variety characteristic, or changes induced by unconscious selection. Some Mexican Indian corn was represented to me by Dr. Palmer as growing to about the height of a man, and as being early maturing. Planted in New York in May, the plants were about eleven feet tall and just approaching bloom in October when cut down by frost.

Zea canina, as grown at Cambridge by Professor Watson, was ten feet tall, and suckered greatly; as grown by Harshberger, at Philadelphia, it was but five feet tall, and tillering is neither noted nor figured. Moisture seems to develop height, aridity to dwarf. When weeds, the great robbers of moisture from land, are allowed to develop freely in a cornfield, a moist spot will frequently bear corn of the normal height, while a neighboring drier hillock yields only dwarfed and stunted specimens. On the other hand some varieties seem to remain dwarf under all conditions observed. The tallest forms are recorded from hot and moist tropical regions, but so also are low-growing varieties.

Contributions to American Bryology.—VIII.

By Elizabeth G. Britton.

A REVISION OF THE GENUS BRUCHIA, WITH DESCRIPTIONS OF TYPES, AND ONE NEW SPECIES.

(Plates 213–217.)

BRUCHIA Schwægr. Suppl. 2: 91 (1824).
PHASCUM Schreb. De Phasco Obs. (1770) in part.
SPORLEDERA Hampe, Linnæa, 279 (1837).

The genus *Bruchia* was founded by Schwægrichen in 1824 for *B. flexuosa*, which had previously been described under *Phascum* from specimens sent by Muhlenberg. The type species, therefore, is American, and the genus reaches its greatest development in North America, only two European species being so far known. Several have been described from Central and South America, and three from South Africa.

Müller in his Synopsis Muscorum, 1849, recognized 7 species, of which four were American, and subdivided the genus into two sections:

I. Sporledera Hpe. (*B. Beyrichiana*, *B. palustris*, *B. brevipes*).
II. Eubruchia. (*B. flexuosa* and var. *minor*).

In the first section he placed the subacaulescent species, and in the second the taller, stemmed species with exserted capsules and long necks.

Jæger, in his Musci Cleistocarpi (1869), recognized two genera.

I. *Sporledera* Hpe. (*S. palustris*, *S. Beyrichiana*, *S. Ravenelii*, and *S. setifolia* from North America, and three exotic species).

II. *Bruchia* Schwægr. (*B. brevipes*, *B. brevifolia*, *B. microcarpa*, *B. flexuosa* and *B. Bolanderi* with four exotic species).

He divided the genus *Bruchia* into two sections:

A. *Garckidium* (*B. brevifolia*, *B. brevipes* and two exotic species).

B. *Eubruchia* (*B. flexuosa*, *B. microcarpa* and *B. Bolanderi* with one of the European species).

When Sullivant's Mosses of the United States was published in 1856, he recognized five species in this genus: *B. flexuosa*, *B. Beyrichiana*, *B. brevipes*, *B. brevifolia*, and *B. Ravenelii*, with *B. palustris* under *Pleuridium*.

In the Icones Muscorum (1864) he figured four of these: *B. flexuosa*, *B. brevipes*, *B. brevifolia*, and *B. Ravenelii*. Of *B. Beyrichiana* he secured an original specimen from Hampe, and states that this species is "an immature state of *B. brevipes*."

In the Supplement to the Icones (1874) he changed his mind about *B. Beyrichiana*, and figured it, not from the original specimens, however, but from those collected by Ravenel on the Santee Canal. He also added *B. Bolanderi*, making six species in all.

Ten years later, in the Manual, Lesquereux and James recognized fourteen species, including *B. palustris*, adding four of Austin's species, *B. Sullivanti*, *B. Hallii*, *B. Donnellii*, *B. Texana*; two of their own, *B. brevicollis* and *B. curviseta*, and a Chilian species which never should have been included, *B. Hampeana* Müller.

Since then Prof. Eaton has described one new species, *B. longicollis*. Illustrations of most of these have been published. Plates of Austin's four species have been drawn for this contribution from the original specimens in his herbarium. *B. curviseta* L. & J. has not been figured, but it is very close to *B. Texana*, and the type specimens in James' Herbarium are not accessible.

In this contribution we have limited the name *B. flexuosa* to the type species, reduced *B. brevicollis* to it, rejected *B. Beyrichiana* as a mixed and uncertain species, limited the name *B. brevipes* to the African species and replaced it for American specimens by *B. Drummondii*, discarded *B. Hampeana*, a Chilian species, maintained

B. Carolinæ, and added *B. fusca* as a new species. Besides this, two other North American species, *B. microcarpa* and *B. setifolia*, still remain uncertain. They were described by Jæger from manuscript names of Wilson, but the specimens in Wilson's Herbarium do not agree with those in Jæger's, and though they probably antedate some of the more recent species, we cannot prove it. We have also learned of another species in the herbarium of Dr. C. Müller, which was collected in Alabama by Dr. Chas. Mohr, whose name it bears, but we have seen no description nor specimens.

It will be seen from the following pages that the specimens and their names have been very much confused, and it has only been through an extensive series of comparisons, drawings and measurements that we have been able to settle a few of the doubtful species.

Through the kindness of M. Eugene Autran and the authorities at Kew and South Kensington I have been able to see all the available European types. By the kindness of Dr. Robinson, Sulivant's whole collection of the genus was placed at my disposal, and Prof. D. C. Eaton also conferred on me a similar favor. Dr. S. E. Jelliffe has verified all my spore measurements.

A thorough examination of the specimens in Wilson's and Hampe's herbaria at South Kensington, London, would probably throw more light on some of the doubtful points, and as we shall show, Dr. Müller could, if he would, settle two others. We still feel that more study is necessary to properly understand the genus, and we would ask collectors in our Southern States to pay particular attention to it, as even yet more new species may be looked for.

Classification.

I. EU-BRUCHIA. Neck of the capsule equal to or shorter than the spore-sac; seta immersed or very slightly exserted; lid not differentiated.

a. Caulescent species.

1. Paroicous Leaves subulate, more or less papillose; spores spinose. (*B. flexuosa*, *B. Sullivanti*, *B. Texana*, *B. curviseta*, *B. Donnellii.*)

2. Autoicous. Leaves short, smooth, erect-appressed, concave, clasping, vein not excurrent into a subulate point; spores reticulate or pitted. (*B. Hallii*, *B. fusca.*)

b. Acaulescent species. Autoicous. Leaves subulate, smooth, serrate or dentate; capsules almost sessile.

1. Spores reticulate. (*B. Drummondii, B. Ravenelii.*)

2. Spores pitted. (*B. brevifolia, B. Carolinæ.*)

II. TREMATODONTOIDEÆ. Neck of the capsule longer than the spore-sac; seta much exserted, lid differentiated but not dehiscent. Spores papillose. (*B. Bolanderi, B. longicollis.*)

III. SPORLEDERA. Capsule without any neck, rounded at base, immersed on a very short seta; calyptra small apical. (*B. palustris.*)

KEY.

Neck shorter than the spore-sac, or equal to it; lid undifferentiated; seta immersed or slightly exserted.

Caulescent, paroicous; seta 3–5 mm. long, exserted.

Leaves 1–3 mm. long, subulate, awn smooth or papillose.

Spores spinose, .025–.035 mm.; calyptra smooth.

Capsule ovoid, neck short, leaves nearly smooth.

1. ***flexuosa.***

Capsule elongated, neck long; leaves subpapillose.

2. ***Sullivanti.***

Spores reticulate, .035–.045 mm.; leaves subpapillose.

Plants 5 mm. high, seta erect, neck large.

3. ***Texana.***

Plants 2–3 mm. high, seta curved, neck contracted.

4. ***curviseta.***

Spores papillose, .032–.037 mm.; leaves papillose.

5. ***Donnellii.***

Leaves short, smooth, not subulate, vein ending in or below the apex. Autoicous.

Spores papillose, .030–.045 mm.; leaves ovate-lanceolate.

6. ***Hallii.***

Spores pitted, .020–.027 mm.; leaves triangular.

Apex acuminate, vein percurrent, capsules orange above.

7. ***brevifolia.***

Apex blunt, vein ending below it, capsules brown.

8. ***fusca.***

Acaulescent, 1–3 mm. high, autoicous; seta and capsule immersed.

Spores reticulate, .025–.035 mm.; capsules orange-colored.

Leaves slender, serrate; calyptra smooth.

9. ***Drummondii.***

Leaves spinose-serrate; calyptra papillose.

10. ***Ravenelii.***

Spores pitted, .024–.027 mm., calyptra papillose.

11. ***Carolinæ.***

Neck equal to or longer than the spore-sac, lid differentiated but not dehiscent; seta long-exserted. Spores papillose, .020–.025 mm.; calyptra smooth.

Leaves short, acuminate, serrulate; neck abrupt.

12. ***Bolanderi.***

Leaves short, subulate; neck tapering.

13. ***longicollis.***

Neck none, the base of the capsule rounded; calyptra small, apical.

14. ***palustris.***

1. Bruchia flexuosa (Schwægr.) Müller.

Phascum flexuosum Schwægr. Suppl. **2**: 1, *t. 101* (1823). excluding *figs. 3 and 8.*

Bruchia flexuosa Müller, Bot. Zeit. **5**: 99 (1847).

Bruchia Beyrichiana Sull. Icon. Suppl. 25, *t. 15* (1874); L. & J. Man. 47 (1884).

Bruchia brevicollis L. & J. Man. 47 (1884).

Phascum flexuosum Sw.; Muhl. Cat. 98 (1813)? Name only.

Muhlenberg's Catalogue cites Swartz as the authority for this species, but without reference, giving the name only. Mr. J. H. Redfield searched, at my request, in Muhlenberg's Herbarium for the specimens, but no mosses could be found in the collection. The specimens he sent to Schwægrichen, which were described and figured in the Supplement must stand as the types, as shown by the following description.

> "*P. flexuosum* Muhlenberg Catalogus Plantar. Americæ Septentr. p. 98.
> "In terra nuda Pensilvaniæ lectum misit beatus Muhlenberg."

These specimens are preserved at the Boissier Herbarium at Geneva, and through the kindness of M. Barbey and M. Autran we have been permitted to examine them.

There are six separate plants, pasted on a sheet of paper, at the botton of which is written, "*Phascum flexuosum* Pensilv.," and above is a drawing of a cucullate calyptra like the one figured in Fig. 8. The plants bearing fruit are three in number, two of them nearly 5 mm. high, with stems simple, the lower leaves rudimentary, the upper crowded around the seta, reaching to the base of the sporange in two of them, and to the apex or a little beyond it in the third, which is less mature than the others. The leaves are erect or slightly secund, 1.5–2 mm. long, slightly broad at base, suddenly contracted into a straight or flexuose awn, roughened on the back by the thickening of the short transverse walls of the vein, serrulate at apex, ending in three longer, clear cells; vein thick, broad, nearly filling the whole of the awn; cells of the basal blade rhomboidal, becoming lax oblong at base, and sometimes serrate at apex, below base of the awn. Monœcious, the antheridia in the axils of the upper leaves, near the perichætium, one or two, without paraphyses. Seta erect or slightly curved (two erect), 2 mm. long, vaginule brown, capsule 1–1.5 mm. long (one immature), yellow, or brown when mature, ovoid, apiculate, beak sharp, straight, neck short, dense, ending abruptly at the base, stomatose, spores ·025–.035 mm., rough, spinose.

The calyptra is not preserved with the type, and the one figured (Schwægr. Suppl. **2**: 1, *t. 101, fig. 8*) seems to belong with Fig. 3 to a *Pleuridium* rather than a *Bruchia*. It is described in the text

> "Calyptra campanulata, angusta, latere fissa, vix dimidio minor quam capsula."

It is probable that there was a mixture in the original specimen. It should be noted, in support of this view, that the base of the capsule in fig. 3 is abrupt, while in figs. 2 and 7 it has a distinct neck; also that it protrudes laterally and the leaves far overtop it in fig. 3, while in fig. 2 it is almost erect on a slightly curved seta and the leaves reach to its base or only a little beyond it, as in the specimens preserved.

Two other statements in the description contradict each other, and may be verified by the figures and the specimens:

> "Caules lineas duas ad quartor alti; pedicellus lineas tres vel quartor emetiens."

The stems are not higher than 5 mm. (4 lines would be 8 mm.) in the specimens, and the pedicels are only 2 mm. long (not 6–8 or 3–4 lines).

BRUCHIA BREVICOLLIS L. & J. Man. 47 (1884).

Bruchia Beyrichiana Sull. Icon. Musc. Suppl. 25, *t. 15* (1874), not Hpe.

In Lesquereux and James' Manual, on page 47, the statement is made that table 15 of Sullivant's Icones Supplement is partly drawn from specimens of *B. brevicollis* L. & J. collected by Ravenel, on the Santee Canal, South Carolina. Hence it became necessary to see Sullivant's specimens. Through the kindness of Dr. Robinson and Mr. Fernald these were sent to me, and I found in the cover all the specimens cited by Sullivant (Icones Suppl. p. 25), including a small portion of the type of *Sporledera Beyrichiana* Hampe, collected by Beyrich, near Baltimore, 1833, and sent to Sullivant by Hampe in 1860. Below the packet Sullivant had written:

"As I supposed, *Sporledera* (*Bruchia*) *Beyrichiana* Hampe is an immature state of *B. brevipes* or *B. flexuosa*. These specimens belong to *B. brevipes*. Schwægrichen's figure is founded on *B. flexuosa*, W. S. S."

This is substantially the opinion he published in the Icones page 24, under *B. brevipes;* later he crossed over these remarks and wrote on the packet "good species," but the description and plate in the Supplement to the Icones were drawn from Ravenel's specimens, as his herbarium shows. He cites the following synonyms and localities:

Sporledera Beyrichiana Hampe, Linn. **20**: 279 (1837).

Phascum Beyrichianum Schwægr. Suppl. **4**: *t. 301* (1842).

Bruchia Beyrichiana Müll. Bot. Zeit. **5**: 99 (1847).

Hab. first found near Baltimore, by Beyrich; Santee Canal, Ravenel; Burlington, New Jersey, James; North Illinois, Dr. G. Vasey.

All of the specimens above cited, except those collected by Ravenel, are immature, but a careful comparison one with another has enabled me, from leaf characters and imperfect fruiting characters, to say that Sullivant was nearer right in his first opinion than in his last, and that most of the description and all of table fifteen in the Icones Supplement were drawn from the only perfect specimens he had, those collected by Ravenel; hence these must be considered the types of *Bruchia Beyrichiana* Sull. They prove also that *B. Beyrichiana* Sull., is quite distinct from *Sporledera Beyrichiana* Hampe. When compared with Hampe's original, Sullivant's specimens are taller and more densely leafy, the stems quite developed, 2 mm. long, several with the leaves and capsules included reaching 4–5 mm. Hampe's are almost acaulescent, with the leaves crowded at the base, the whole plant not attaining 2 mm. in height. The leaves also show a marked difference; Sullivant's are falcate-secund when dry, erect when moist, with a long slender tip entire below, but distinctly serrate at apex, often 6–8 of equal length, crowded at the apex of the stem; Hampe's are flexuous, recurved and twisted, with a longer, broader base and a stouter point, which when highly magnified shows the short transverse walls to be thickened, giving the back of the leaf the appearance of being papillose, whereas Sullivant's are often perfectly smooth, with the same magnification.

Both have erect pedicels, but Sullivant's are exserted, whereas Hampe's are immersed, and the calyptra in the latter is larger and more lobed. Certainly these two are not the same species.

And as *Sporledera Beyrichiana* Hpe. (Linnæa, **9**: 279,), antedates *Bruchia Beyrichiana* Sull. (Icon. Musc. Suppl. 25, *t. 15*,

1874) by thirty-seven years, it is the latter which must change its name, and the former must be dropped, as it is a mixed species founded on immature specimens. Fortunately there is a name which unquestionably belongs to *B. Beyrichiania* Sull., for in the description of it in L. & J. Manual, page 47, they say, "Sull. Icon. Musc. Suppl. 25, *t. 15*, partly made upon specimens of the next species."

The next species is *B. brevicollis* L. & J., founded on specimens collected by H. W. Ravenel, Santee Canal, South Carolina; according to their own citation, the very ones cited by Sullivant in the Icones Supplement under *B. Beyrichiana*. A further comparison of the descriptions in both will show that those in the Manual are transcribed from the Icones with a slightly incorrect modification, and a very imperfect characterization for their new species. Omit the words "its top not surpassing the leaves;" change "partly" to "entirely;" combine the two descriptions, omitting all references to *B. Beyrichiana*, and there will remain a good characterization of Ravenel's specimens, with the additional evidence that the spores are large and rough in Ravenel's specimens and are so figured in the Icones, but no mention is made of them in the Manual.

That Sullivant should have drawn table 15 from several specimens is not probable, and contrary to what we know of his careful methods, furthermore the other specimens referred to in the Icones are preserved in the same cover with the above in Sullivant's Herbarium. Those collected by T. P. James, at Burlington, N. J., are immature, but they do not agree with either of the above, when placed side by side under the same cover-glass. They have leafy stems 2 mm. high, but the leaves are subpapillose, and the pedicels stout and recurved with immersed capsules, not sufficiently matured to show the spores. They are probably immature specimens of *B. Sullivanti* Austin. Dr. George Vasey's specimens from Illinois are also immature, so young that they are still acaulescent, the calyptra is only just formed and the capsule is yet a mere thickening of the stout, curved pedicel. The leaves are subpapillose on the back, and specimens preserved in Austin's Herbarinm, labeled "*Bruchia Beyrichiana*, Ringwood, McHenry Co., Ill., collected by Dr. Geo. Vasey," are corrected by Austin to *B. Sullivanti* Aust. It is evident then that the only specimens in Sullivant's Herbarium from which he could have drawn the figures which were used in the Icones were those collected by Ravenel which Lesquereux and James say are the ones on which they founded *Bruchia brevicollis*.

In order to determime if Ravenel's specimens were sufficiently distinct from the type of *Phascum flexuosum* to maintain *B. brevicollis* as a species, they were placed together and carefully compared.

The best developed specimen of the type is almost an exact counterpart of one of Ravenel's specimens. In both an occasional trace of roughness may be seen on the leaves, although most of them are smooth, slender and subulate; the pedicels are the same in length and position, the capsules smaller, but the proportions of the neck, beak and sporange are the same.

BRUCHIA BEYRICHIANA (Hpe.) Müller.

Sporledera Beyrichiana Hampe, Linnæa, **11**: 279 (1837).

Bruchia Beyrichiana Müll. Bot. Zeit. **5**: 99 (1847). Sull. Mosses U. S. 17 (1856.)

Phascum Beyrichianum Schwægr. Suppl. **4**: *t. 301* (1842).

On page 279 of Linnæa, Hampe says, "Die Capseln sind freilich nicht ausgebildet, aber doch die Form schon zu erkennen." He describes the specimens as follows:

> "Muscus flavescens, *Phasco subulato* simillimis, foliis inferioribus ex basi latiore subulatis nervosis, perichætialibus latioribus et longioribus, complicatis integerrimis secundis vel flexuosis. Capsula oblonga erecta-pedunculata, calyptra campanulata eadem includente."

I have not seen Hampe's own specimen of this species, but the one sent to Sullivant by him is too immature to show even the form of the capsule, for that had not begun to be formed, the calyptra and pedicel being still immersed in the leaves. In fact, the plants had only perfected the calyptras, and are still too young to say whether the pedicels would be erect or curved, though there is a slight twist in the seta just below the calyptra. The other characters have been described in the comparison with *B. Beyrichiana* Sull. given above. The following measurements are placed on record as the earlier descriptions are all too indefinite.

Sporledera Beyrichiana Hpe. l. c.

Almost acaulescent, about 2 mm. high, light yellow, with the leaves crowded, sometimes 6–8 of equal length, flexuose, base ½–⅓ the length of the awn, vein broadest where the awn starts, margins sub-serrulate, apex ending in 1–3 larger clearer cells, those of the back of the leaf, subpapillose, by the thickening of the short transverse walls of the cell, seta short, erect, slightly bent at apex, as if becoming arcuate, calyptra large, .075 mm. long, .050 mm. wide, lobes 6–8, not very deep. Capsule and spores not yet formed.

Type locality near Baltimore, Beyrich (1833).

Mr. Anthony Gepp, of South Kensington Museum, sent me copies of drawings from Hampe's specimens made by him and Carl Müller showing that the type is no more developed than the portion of it in Sullivant's Herbarium, hence we shall have to drop *B. Beyrichiana* from the list of North American species, as it is utterly impossible to tell what the character of its capsules or spores might be.

Phascum Beyrichianum Schwægr. Suppl. *t. 301* (1842). The type of this species was sent to us from the Boissier Herbarium and was compared with Hampe's specimens of *Sporledera Beyrichiana*, from Sullivant's Herbarium. I find no record of locality on the sheet other than "Am bor.," though the text says:

> "In America boreali D. Schweinitzio lectum, dedit D. Arnott; *Sporlederam* a Beyrichio Baltimoræ lectam E. Hampe habet."

Evidently then they were not the same specimens nor gathered by the same collector, though Schwægrichen gave his the same specific name and referred Hampe's to it as a synonym. When compared the plants are taller than Hampe's 2–3 mm. high, light yellow, with longer more papillose, twisted leaves, with involute margins, channeled vein, curved pedicel, over 1 mm. high; the capsules still immature, but sufficiently developed to show the long neck of a *Bruchia*. (See Figs. 6–7, *t. 301*). Comparing the plants with Plate 301, the figures which are not correct are Fig. 8, which would seem to belong to an *Orthotrichum*, as the young immature capsules of the type are perfectly smooth, and Fig. 5, of the apex of the leaf, which is too broad and blunt as seen with the improved objectives of modern microscopes, and should be figured with a serrulate tip to agree with type specimens.

Therefore it seems likely that these plants are, as Sullivant supposed (Icon. Musc. 24) immature specimens of *B. Sullivanti* Aust. (*B. flexuosa* Sull.), but they might be *B. curviseta* L. J., which also has a flexuose seta, and subpapillose leaves, and without the mature capsule and spores it will be impossible to refer either of these names to *B. Beyrichiana* Müll. as synonyms, for we should be forfeiting a certainty for an uncertainty, therefore it seems best to drop *B. Beyrichiana* from the list of *Bruchias*, especially as its synonymy is already in a sad state of confusion.

2. BRUCHIA SULLIVANTI Austin.

Bruchia Sullivanti Aust. Bull. Torr. Bot. Club, **6**: 143 (1877).

Bruchia flexuosa Sull. Icon. Musc. *t. 13* (1864).

Bruchia flexuosa, of Sullivant's Icones, was believed by Austin to be a mixed species, composed of the true *B. flexuosa* and *B. Sullivanti* Austin, to which he referred the plate in the Icones, but not the description.

Bruchia flexuosa Sulliv. Icones (excl. descript.), *t. 13;* Aust. Musc. Appalach, No. 56; haud Schwægr.

> "Statura facieque *Br. flexuosæ*, sed inflorescentia paroica foliis subpapillosis, etc., statim dignoscitur."

> "Capsule concolorous, the collum much constricted in drying, pale, yellow, becoming fuscous. Spores minute (about $\frac{1}{750}$–$\frac{1}{900}$ of an inch in diameter), yellow, opaque, papillose. Leaves mostly longer than the pedicel (often over-topping the capsule), more or less papillose above (often very obscurely so), nearly or quite entire. Occurs on damp ground, from New England to Florida and Louisiana."

Such is the description given by Austin, and the localities cited below are too general to indicate what he considered the type of his new species, and his Musci Appalachiani (1870) were issued before the publication of this species. Number 56 of his exsiccatæ, however, may be considered to be *B. Sullivanti*, as shown by specimens in his herbarium, from Closter, the locality given for No. 56. These specimens are labeled "*Bruchia flexuosa*," collected in 1862 near Closter," and below is written "*Br. Sullivanti*." (The first quotation marks are his, and evidently refer to his previous naming of the specimens.)

No. 56 in our herbarium was compared with the type from Geneva, and they show the same differences that Sullivant's specimens do, the longer more flexuose seta, more slender capsule, clearer neck, shorter, more subpapillose leaves. Mixed with Austin's *B. Sullivanti* are specimens which do agree with the type of *Br. flexuosa*, and these are labelled *B. brevicollis* L. & J. Those collected by J. Donnell Smith in Prince Edward County, Va., in 1878, are labelled *B. brevicollis* L. & J., in blue ink, and above Austin has written *B. Sullivanti* var. *brevicollis*, Austin. They differ according to Austin's notes in the plants being "shorter with longer leaves, smooth on the back of the awn, dentate at apex, less canaliculate, with the capsule smaller, shorter beaked, the spores exactly as in *B. Sullivanti*, neck short, opaque. The seta is as often erect and straight as it is bent."

At the foot of the page (BULLETIN, **6**: 143), Austin says:

"The true *Bruchia flexuosa* Schwægr. with autoicous inflorescence and with spores about as in *Br. Sullivanti*, is given in S. & L. Exsic. Ed. 2, n. 41. The specimens were probably collected in Ohio. I have not seen it from any other source."

Austin did not have the type, nor could he have seen it, and he was mistaken in saying "with autoicous inflorescence," for the type, as we have already shown, is paroicous; but the specimens referred to above (No. 41) were examined in our set, compared and drawn side by side with the type, under the camera. The type again has shorter and broader capsule, maintaining the same differences that it does to all the rest of Sullivant's specimens.

And lastly, No. 41 was compared with Austin's 56, and they too both show with a magnification of 300 diameters the same, short, thickened transverse walls on the back of the vein, which gives it the subpapillose appearance.

Bruchia flexuosa Sull. Icon. Musc. 22, *t. 13* (1864).

The specimens found in the cover of *Bruchia flexuosa* sent to me from Sullivant's Herbarium are labelled and numbered as follows:

44. *B. flexuosa*, Texas, Wright, 1845.

60 and 65. *B. flexuosa* Br. & Sch., Lancaster, Ohio, Lesquereux, 1849.

B. flexuosa var. ? Cleveland, Ohio, Dr. Cassell, June, 1856.

B. flexuosa, Columbus, Ohio, Lesquereux, May, 1861.

172. *B. flexuosa*, eight miles below Portsmouth, Va., T. P. James, March, 1867.

173. *B. flexuosa*, near Petersburg, Va., T. P. James, April, 1867.

176. *B. flexuosa* var. *nigricans*? Moyamensing, Philadelphia, Pa., T. P. James, May 30th, 1866.

32. *B. flexuosa* var. *nigricans.* "Spores the same as in the type." Without locality or date, presumably No. 42, S. & L. Musci bor. Am. from Raccoon Mt., Alabama.

There are also three other small packets without locality, date or collector.

Two drawings also are preserved, one of which I cannot satisfactorily match to the specimens. It is labelled "*Bruchia flexuosa*, Hab. Ohio and Southern States, W. S. S., July, 1850," and may have been drawn from one or more specimens.

The other drawing is labelled "*Bruchia flexuosa* var.? Cleveland, Ohio, June, 1856—Dr. Cassell's," the specimens of which are preserved as shown above. These are the ones referred to the variety *nigricans*, in the Mosses of the United States, page 17 (1856), though later in the Icones (1864) he used the drawings made from them to illustrate what he considered the type of the species, though it must be borne in mind that the specimens in Schwægrichen's Herbarium, and not Sullivant's, are the types.

These specimens of Dr. Cassell's, when placed side by side under the same cover with the *type*, show the leaves to be somewhat shorter and broader, *less rough*, the seta also shorter, but the capsule longer and narrower, with a longer beak, and the spores the same in size and roughness. In the original drawing, but omitted from the Icones, the antheridia are indicated in *Figs. 2–3* as naked, in the axils of the leaves below the perichætium, as in *Fig. 13*. *Fig. 4* was added to the Icones, and does not occur in the original drawing. Sullivant has written on the back of the drawing: "I am unable to find any tangible characters to separate these specimens (Cleveland, Dr. Cassell's) from *Bruchia flexuosa*. These specimens are not as slender as usual in *B. flexuosa*, more condensed, pedicel shorter and leaves shorter, etc. The spores .03–.0325–.035 mm. The spores of *B. flexuosa* are the same."

This raises the question as to what specimens Sullivant considered typical; as far as we can learn from his herbarium he had not seen the type specimens. Presumably these would be the specimens which he distributed in 1865 as Number 41 of S. & L.

Musci bor. Am., but without locality. Judging from his herbarium, it must be either the specimens numbered 60 and 65, sent him by Lesquereux, collected at Lancaster, Ohio, in 1849, or those from Columbus, Ohio, May, 1861, also collected and sent to him by Lesquereux; probably the latter, for the second set of these exsiccatæ were put up by Lesquereux, all the duplicate packets bearing his German figures to correspond with the numbers on the tickets. These, too, were compared with the type, and they show the same differences as Dr. Cassell's, even more accentuated. The pedicels are much longer, more exserted and flexuose, the capsules narrower and longer with a longer beak and neck, leaves shorter and more spreading. With the higher powers the walls of the cells on the back of the vein are more thickened than in the type, and the margins are subserrulate. These spores are a little smaller and roughened in the same way as the type. It will be seen, then, that there is not in Sullivant's cover of *B. B. flexuosa* an exact match for the type from Geneva. His specimens all match *B. Sullivanti* Austin, and the specimens in his herbarium which match the types are in the cover of *B. Beyrichiana*, which we have shown he figured in the Supplement to the Icones, plate 15 as that species.

That *B. flexuosa* and *B. Sullivanti* are very closely allied and probably grade into each other is proven by the above comparisons, but that the differences between them are noticeable is shown by the several names which they have given rise to. We think it probable that *B. flexuosa* is a common and variable species, from which *B. Sullivanti* may be separated as of secondary or lower rank.

Bruchia flexuosa var. *nigricans* Sull. Mosses U. S. 17 (1856).

Bruchia nigricans Austin, Bull. Torr. Club, **6**: 143 (1877).

Bruchia Sullivanti var. *nigricans* Lesq. & Jas. Man. 46 (1884).

It should be noted that Sullivant, in the above citation, says: "Whole plant longer; leaves shorter, appressed; spores larger, dark brown. . . . Raccoon Mountains, Alabama, Lesquereux, and 'Cleveland, Ohio, Prof. Cassell.'"

He subsequently figured in the Icones (1864) the last named specimens as the species, as shown above, and referred the specimens from Raccoon Mountains only to the variety. These were distributed as No. 42 of S. & L. Musci Bor. Am. Ed. 2 (1865), of which there is only one specimen preserved in Sullivant's Herbarium bearing a single capsule. The sterile specimens are much more branching than is usual in the genus. Specimens of No. 42 in our herbarium, two sets in the Jæger Herbarium and those in Prof. Eaton's set have been examined and the spores measured. They vary considerably in size. In our set they are larger, .036–.045 mm., rough, though not spinose, and the outlines of the spores is not very regular. In the Jæger sets I find some spores as small as .027–.029 mm., but with same characteristic surface. These latter have the capsules long-beaked, on a curved seta.

The differences, however, do not seem to be sufficient to separate it as a species, and the remarks by James in the Proc. Am. Acad. **14**: 135, 1879, and in the Manual would seem to account for its variation.

"The variety is evidently due to immersion, as higher upon the dry sand of the borders of the depressions the moss gradually assumes its normal form."

3. BRUCHIA TEXANA Aust. Bull. Torr. Bot. Club, **5**: 21 (1874).

(Plate 213.)

Paroicous, the antheridia naked in the axils of the upper leaves. Plants gregarious, light yellow, varying in size at maturity in the same patch, 3–5 mm. high; stems simple, erect, 2–3 mm. high; leaves smaller at base, crowded around the base of the seta, not reaching the capsule, uppermost 1–1.5 mm. long, broadly clasping at base, contracted into a short subulate awn, composed principally of the thick vein, slightly rough on the back, ending below the serrate apex, narrow and distinct at base; cells of the basal lamina oblong and lax below, becoming irregular, crowded, and serrulate along the awn; seta 1–1.5 m. long, erect, or twisted and recurved, exceeding the leaves; capsule 1.5–2 mm. long, bright orange above, with a long, slender beak; neck large, paler, and contracted when dry, abrupt at base and stomatose, half the length of the capsule, calyptra not reaching the neck; spores yellow, spinosely reticulate, .040–.045 mm., maturing in?

Type locality near Houston, Texas, Hall, also collected by Wright in Texas, 1845, in herb Sullivant under *B. flexuosa* (No. 44). Since collected in South Carolina by Ravenel, and Alabama by Chas. Mohr.

Differing from *B. flexuosa* with which it is mixed in Sullivant's and Austin's Herbaria, in the longer seta, shorter leaves, and larger reticulate spores. The specimens credited to Virginia collected by J. D. Smith in Austin's Musci Appalachiani, Supplement, No. 463, are *B. Drummondii* in Austin's Herbarium. *B. curviseta* L. & J., is very closely allied to this species.

4. BRUCHIA CURVISETA L. & J.

Bruchia curviseta L. & J. Man. 47 (1824).

B. Vogesiaca var. 2, Drummond's Southern Mosses, No. 15, in part.

B. Texana Austin, Musci Appach. Suppl. No. 463, in part.

The description in the Manual is good, but the following measurements should be added from Drummond's specimens:

Plants short, 2 mm. high, upper leaves 1 mm. long, often reaching to the summit of the capsules; blunt, dentate or serrate at apex; seta short, .0.5–1 mm. often bent abruptly in two directions; capsules small, 1 mm., neck contracted below the spore-sac when dry; spores spinosely reticulate, .032–.040–.045 mm. the reticulations often .008–.013 mm. in size.

Specimens were distributed by Austin in his Musci Appalachiana as No. 463 as *B. Texana*, collected by Ravenel in South Carolina. It is very close to that species but smaller, and the spores are perhaps slightly more distinctly reticulate than in *B. Texana*.

The type locality is uncertain, as two are given. The label of Drummond's No. 15 reads "Louisiana and New Orleans," and the specimens are mixed with *B. brevifolia* Sull. in Sullivant's set, and with that species and two others, *B. Sullivanti* and *B. Drummondii* (*B. brevipes*) in our set.

Austin also had it from Maryland, collected by J. Donnell Smith, labelled *B. Sullivanti*, "spores too large," and from Prince Edward County, Virginia, also from J. Donnell Smith, and from South Carolina, collected by H. W. Ravenel.

5. BRUCHIA DONNELLII Aust.

Bruchia Donnellii Aust. Bull. Torr. Bot. Club, 6: 144 (1877).

(Plate 214.)

Paroicous, the antheridia naked in the axils of the upper leaves. Plants gregarious in light yellowish green patches, 5 mm. high;

stems erect, 3–4 mm. high, slender, flexuose, leafy to base; leaves curled and recurved, spreading when dry, 1.5–2 mm. long, suddenly contracted into a rough subulate apex, from a broad, hyaline clasping base; lower cells smooth, clear, upper papillose by the thickening of the walls, margins more or less recurved and serrate above; seta exserted, erect or curved, 1.5–2 mm. long, capsules nearly 2 mm. long, orange-colored becoming brown, apiculate, beak straight; neck large, half the length of the capsule, tapering, stomatose; calyptra smooth, lobed; spores .032–.037 mm. papillose, maturing in early spring, from February to April.

Collected at Jacksonville and Rosedale, Florida, by J. Donnell Smith, 1877–1878; also at Gainesville, Florida, by C. E. Faxon, and Aiken, South Carolina, by H. W. Ravenel.

Exsiccatæ: Austin Musci App. Supp. 464.
S. & L. Musci Bor. Am. Ed. 2d, No. 41 in part.

Very nearly allied to *B. Texana* and *B. curviseta*, from which it differs in its papillose not reticulate spores and distinctly papillose leaves.

6. BRUCHIA HALLII Aust.

(Plate 215.)

Bruchia Hallii Aust. Bull. Torr. Bot. Club, 5: 21 (1874).

Paroicous, the antheridia axillary in the upper leaves. Plants 4–5 mm. high, gregarious in light green patches; stems simple erect, 2–3 mm. high; leaves erect-appressed, the lower short, the upper not longer than 1 mm., all ovate-lanceolate, entire or serrulate, the vein ending in the acute apex; basal cells larger, very lax, upper fusiform or rhomboidal, marginal elongated, occasionally serrulate; perichætial bracts broader, clasping; seta erect or curved, 1–1.5 mm. long, exserted; capsules 1–1.5 mm. long, brown, pyriform, apiculate, beak long, straight, neck tapering, paler than the brown wall of the upper half of the capsule, stomatose; calyptra smooth, lobed, covering only the upper part of the capsule; spores large, .043–.048 mm., papillose, maturing in February.

Type locality not recorded; collected in Texas by E. Hall, February 23, 1876, growing with *Ditrichum pallidum*.

7. BRUCHIA BREVIFOLIA Sull.

Bruchia brevifolia Sull. Moses. U. S., 17 (1856) Icon. Musc. 25, *t. 15* (1864).

In Sullivant's Herbarium are preserved three sets of specimens as cited by localities in the Icones, and the original drawing of t–15 is also preserved, but it bears no label to indicate from what specimen it was made; it is dated 1857. The specimens issued in Drummond's Southern mosses No. 15, as *Bruchia Vogesiaca* var. 2. Hab. Louisiana and New Orleans, were mixed both in Sullivant's set and ours. Three different species have been separated from it, two new, *B. curviseta* L. & J. Man. 47 (1884), *B. brevifolia* Sull. (1856), and *B. Sullivanti* Austin (*B. flexuosa* Sull.), the last being preserved with *B. brevifolia* in Sullivant's Herbarium, and mixed with it also in our specimen, hence probably the following comparison of Sullivant's. It will be noted that he reiterates the statements made in the Mosses of the United States that the spores are "about the same." This mistake was rectified in the Icones, in tables 13 and 15, Fig. 12, where they differ in one being spinose, the other pitted. In S. and L. Musci Bor. Am. Ed. 2, No. 44, they are young enough to show that four spores are formed in each mother cell.

Bruchia brevifolia (sp. nov. Sulliv).

"Compared with *B. flexuosa*, it is a shorter plant, capsule larger in proportion, more oblong in general outline, not so elliptical, tapering to each end, the operculum shorter, pedical much shorter, not flexuose, scarcely emergent from the perichaetial leaves, which are rigid, erect, connivent, with a much shorter acumination from an oblong more broad obovate sheathing base, the lower stem leaves are triangular, ovate, all with a heavy percurrent costa-reticulation of leaves the same, the spores also about the same, one spore measuring .03 to .03¼ millimeters in diameter. The true *B. flexuosa* is a slender flexuose plant; the *B. brevifolia* is a stiff short stumpy plant.

"*B. brevifolia* is the *B. Vogesiaca* var. 2, No. 15 of Hook. and Wilson in Drummond's Southern Mosses, partly, viz.: the middle specimen in my copy, which see.

"Neither can *B. brevifolia* be considered an immature or young state of *B. flexuosa*, because the capsules and spores are well developed and ripened. *B. flexuosa* preserves its peculiar slender habit in all stages of growth, and in all situations varying, however, a great deal in size; further the two species appear to grow in exactly similar soils.

"*B. brevifolia* is monœcious (see Fig.), the same, however, is the case with *B. flexuosa* notwithstanding Müller Synopsis Musc. says it is dioicous." "W. S. S., July, 1850."

The above comparison would seem to indicate that Sullivant feared the two might be confused, or found in the same localities, but so far as we know, *B. brevifolia* has only been collected in Texas, South Carolina and Louisiana, the latter being the type locality.

8. BRUCHIA FUSCA n. sp.

(Plate 216.)

Autoicous, the antheridia in basal buds; plants gregarious, light yellow or brown, 2–3 mm. high, protonema more or less persistent; stems short, 1–2 mm. long, naked at base, leaves few, three to six, erect-appressed, short, 1 mm. or less, sometimes reaching the base of the capsule, clasping, often broader than long and tricuspidate, entire, or subserrulate with a narrow border of small, retuse cells, apex obtuse, acute or cucullate, vein faint, ending below the apex, or lacking in the lower rudimentary leaves; cells lax at base; seta short, .25–.50 mm. long, immersed or slightly exserted, straight or curved; capsule large and broad, 1–1.5 mm. long, entirely exserted, ovoid-pyriform, suddenly apiculate, neck shorter than, occasionally equalling, the spore-sac, abrupt or tapering to the vaginule; walls of the capsule dense, brown, not transparent, stomata large; calyptra smooth, deeply lobed, half covering the capsule; spores small, .021–.027 mm. brown, angled and pitted, maturing in April.

Growing around quartz pebbles in sandy soil, Maryland, J. Donnell Smith, 1878, also recently collected at the "The Runs, Pine Bluff, North Carolina, April 11, 1891," by Anna H. Searing, M. D., the latter specimens showing the more tapering necks, but agreeing in every other point with those collected by J. D. Smith.

Differing from *B. brevifolia*, to which it had been referred by Austin on account of its short leaves and pitted spores, in the smaller size of the plants, the short, 3-pointed leaves; the vein ceasing below the apex, but more especially in the capsules, which are shorter and broader, brown, not orange-colored, with a shorter neck tapering at the base. From *B. Hallii*, which it resembles in the erect-appressed habit of its leaves, it differs in the shorter seta, longer neck, and the much smaller, pitted spores.

9. BRUCHIA DRUMMONDII Hpe.

Bruchia Drummondii Hpe. in Sched.; Jæger, Musci Cleist. 36 (1869).

Bruchia brevipes Hook. & Wilson in Drummond's Mosses So. U. S. No. 16 (1841).

Bruchia brevipes Sull. Mosses U. S. 17 (1856); Icon. Musc. 24, *t. 14* (1864), non Hooker.

Plants gregarious, glossy, yellow, 3–4 m. high, stems decumbent and naked at base, densely leafy above; leaves 10–15, uppermost often 3 mm. long, erect or subsecund, abruptly contracted from a broad base, less than one-third the length of the slender tip, vein narrow, not occupying all of the serrate, channeled apex, occasionally serrulate on the back; cells narrow, more lax at base. Autoicous, the antheridia in basal buds; seta short, .25–.50 mm. long; capsule erect, immersed or slightly exserted laterally, one or two in the same perichætium, .75 mm. long, apiculate, upper half bright orange-colored, neck shorter, paler, truncate at base; calyptra smooth, lobate; spores .035–.043 mm., reticulate, maturing in March and April.

Type locality, Louisiana, Drummond, on sandy soil; also collected in South Carolina by Ravenel, and near Petersburg, Virginia, by T. P. James.

Differing from Hooker's type of *Bruchia brevipes*, collected by Harvey at the Cape of Good Hope, Africa, in the larger size of the plants, longer more slender leaves, with the vein not occupying all of the apex, the margins distantly but distinctly serrate, larger capsules, and spores which are reticulate, not spinose.

We have received from Mr. Gepp some sketches and notes from Wilson's Herbarium which show that he realized that a mistake had been made in distributing Drummond's specimens under the same name as Harvey's African ones. The following list of manuscript names shows this:

Bruchia flexuosa var. γ.
——— *nana* Wils. mss.
——— *brevipes* H. & W. in Drummd. M. Am.
——— *setacea* Wils. mss.
——— *Drummondii* Wils. mss.

Mr. Gepp notes that the last was used April 7, 1865, and is Wilson's name, though it is the same as the one credited to Hampe in Sched. by Jæger in his Musci Cleistocarpi on page 36 under *B. brevipes.*

Bruchia brevipes Hook. Icon. Plant *t. 231* (1840).

Phascum elegans Hsch. Linnæa **15**: 114 (1841).

The plants from which this species was described were collected at the Cape of Good Hope, by Harvey in July 1837, and are preserved at Kew in Hooker's Herbarium. In 1841 Hooker and Wilson distributed as "*Bruchia brevipes* Harvey M. S.," No. 16 of Drummond's Southern Mosses, collected in Louisiana, with the remark "Capsulis sessilibus foliis non crispatis." In September of 1892 we received from the Natural History Museum at South Kensington a duplicate set of Drummond's Southern Mosses, on No. 16 of which I find pencilled *B. Drummondii*, Wilson M. S. I learn from Mr. Wright that "No. 16 of Drummond's second collection bears no note in the Kew set, but has been laid in with *Bruchia flexuosa.* In an index to the set in Wilson's handwriting it is referred to thus: "*Bruchia elegans* Hrsch. 16 '*brevipes*' is crossed out with red ink."

Wilson must have been mistaken, however, for *Phascum elegans*, Hsch. Linnæa, 15: 114 (1841) was collected at Newland's Cape of Good Hope by Ecklon, and is cited as the same as Hooker's *B. brevipes* (1840), collected by Harvey, and not our American specimens as will be shown below.

Finding that Sullivant (Icon. Musc. p. 24) had not seen Harvey's specimens, I asked for the privilege of seeing Hooker's type, and have compared it critically with Drummond's 16. This comparison proves that they are closely allied, but sufficiently distinct to warrant their separation. At the first glance the aspect of the plants is different, Drummond's being densely gregarious, bright yellowish green and glossy, Harvey's scattered, and dull dark green; in size also they differ, the American plants being throughout from a third to a half larger than the African ones, as the descriptions will show.

Bruchia brevipes Hooker, Icon. Plant, *t. 231* (1840).

Plants scattered, only 2 mm. high, dull dark green, stems simple, erect, leaves 6–10, lanceolate-subulate, longest 2 mm. entire or faintly appressed serrulate, vein broad occupying all of the thick plane apex, or occasionally channeled, and roughened on the back, narrow at the base. Seta short, 25 mm., capsule erect or inclined, almost entirely exserted, .5 mm. long, apiculate and orange colored above; neck short, not conspicuously truncate. Calyptra small, .33 mm., campanulate, (less beaked and lacerate than figured in (t. 231) spores rough, spinose, opaque, yellow, .037–.040 mm., maturing in July (S. Africa). Collected by Harvey along roadside near Newlands, Cape of Good Hope, with *Phascum nervosum.* A specimen was sent by Dr. Ward to Dr. Torrey labelled *Bruchia Bbrevipes* ? C. B. S., W. W. H.

"*Bruchia Drummondii*, Hpe. in Sched," is one of the synonyms cited by Jæger for "*B. brevipes Hook.*" (Musci Cleist. 36, 1869). He limited this name entirely to the American species, and recognized the African as *B. elegans* (Hsch.) citing "*B. brevipes* Hook. e parte" as one of its synonyms. The American specimens should never be cited as *B. brevipes* Hook., but as *B. brevipes* Hooker and Wilson. Müller in his Synopsis Musc. 1: 18, 1849, cites *B. brevipes* Hook. (*B. elegans* Hsch.) correctly, and limits it exclusively to the African species, as we maintain it should be.

10. BRUCHIA RAVENELII Wils.

Bruchia Ravenelii Wilson in Sull. Mosses U. S. 17 (1856). Icones Musc. 26, *t. 16* (1864). Austin Bull. Torr. Club, **6**: 144 (1877).

In Sullivant's Herbarium are preserved the specimens from which the original description by Sullivant was drawn and the drawings from which the plate in the Icones (Icon. Musc. 26 *t. 16* 1864) was engraved. They are labelled in the handwriting of Lesquereux "*Bruchia Ravenelii* Wils. mss. from Ravenel to Lesquereux," and all the characters but one agree with the drawings and require no explanations. The spores are figured and described as "papillose," but they are more properly reticulate, with confluent ridges, forming a honey-combed surface, which is distinctly hexagonally indented, the ridges appearing on the edges as Sullivant has figured them, but not so on the surface. They are small .027–.032 mm. and it is only with a magnification of 400 diameters that this can be distinctly seen. The stomata too are worthy of description, being slightly immersed, not very distinct, with the surrounding cells radiating and covering the outlines of the guard cells.

Specimens in Austin's Herbarium, sent to him by T. P. James, collected on the Santee Canal by Ravenel, from the same locality as the type, show also the same characters. He also had specimens from Aiken and the seaboard in South Carolina, from Ravenel, and some from Mobile, Alabama, collected by Charles Mohr.

We have received from Mr. Gepp tracings from a drawing of some specimens in Wilson's Herbarium labelled:

B. microcarpa Wils. mss.

B. setifolia Wils. litt. ad. T. P. James, Feb., 1855.

They are undoubtedly this species as shown by the papillose calyptra and the reticulate spores, with the short immersed capsules, the antheridia in a basal bud and the subulate serrulate leaves. These being only manuscript names in Wilson's Herbarium, do not affect the question of the name, but Jæger's published descriptions under the above names are not so easily disposed of.

11. BRUCHIA CAROLINÆ Aust.

(Plate 217.)

Bruchia Carolinæ Aust. Bull. Torr. Bot. Club, **6**: 144 (1877).

Bruchia Ravenelii Wils., var. *mollis* L. & J. Man. 49 (1884).

Plants gregarious in brown patches, 1 mm., seldom 2 mm. high; stems short, .5–1 mm. high, naked and radiculose at base; leaves crowded at the summit, more or less secund, 1 rarely 2 mm. long, subulate from a broader base; vein channeled, filling the entire or serrulate apex, faintly papillose on the back; basal cells smooth, irregular, upper with thickened walls. Autoicous, the antheridia in brown basal buds. Seta shorter than the capsules, both immersed, or the capsules occasionally exserted laterally, .5–.75 mm. long, pyriform, yellow or brown, conic apiculate; neck large, truncate, stomata immersed, the guard cells covered by the radiating cells around them; calyptra broad, lobed, papillose at apex; spores small, .021–.027 mm., pitted, maturing in February and March.

Type locality, Aiken, South Carolina, H. W. Ravenel, 1872. Exsiccatæ: Austin Musci App. Supp. 461 (1878), also mixed with *B. Drummondii*, in Drummond's Southern Mosses, No. 16 (1841), in our set; also with *B. brevifolia* in S. & L. Musci Bor. Am. Ed. 2, No. 44 (1865).

Differs from *B. Ravenelii* in its pitted spores and smaller size, from *B. brevifolia* and *B. fusca* in its papillose calyptra and subulate leaves, and from *B. brevipes* in its spores and calyptra.

The types of this species are preserved in the herbarium of C. F. Austin at Columbia College. They have been compared with type specimens of *B. Ravenelii* in Sullivant's Herbarium and with Austin's specimens of this species, as well as with No. 43 of Sull. & Lesq. Musci Bor. Am., Ed. II. and Austin's Musci App. No. 460 and his description in the BULLETIN. The comparisons which he makes there are conclusive that these two must be held as distinct species; that is if spore-characters, aside from all others, are of any value in classification, for the spores of *B. Carolinæ* are as distinctly pitted as those of *B. brevifolia* (Sull. Icon. *t. 15, fig. 12*), while those of *B. Ravenelii* are reticulated with crests as described above. Other differences are evident on careful comparison. The plants are smaller, the capsules less immersed, the calyptra less papillose, the beak longer and more conic, the neck longer and clearer and the spores smaller. The leaves are variable in length, sometimes not reaching the base of the capsule, at others far overtopping it, with the seta erect or curved and the capsules protruding laterally or immersed.

Austin says that the inflorescence may be either synœcious or occasionally autoicous. The type specimens and all the others I have examined show the antheridia in small basal buds, easily distinguished by their darker color.

In Sullivant's Herbarium it is mixed with the specimens which he figured for *B. Drummondii*, Hpe. (*B. brevipes* Hook. & Wilson), but we have compared the figures in the Icones (t. 14), and they all seem to have been drawn from the larger specimens.

UNCERTAIN OR REJECTED SPECIES AND VARIETIES.

Bruchia flexuosa var. *minor* C. Müller, Syn. Musc. **1** : 20 (1849).

Müller, says in the original description as compared with *B. flexuosa :*

> "In partibus omnibus minor, foliis brevioribus strictioribus angustioribus, apice hyalino.
>
> "β. Florida : Schimp. sub nomino *Bruchia brevipedis* Hook. in herb. Hampeano."

Sullivant in the Icones (1864) cites this variety as one of the synonyms of *B. brevipes*, but makes a mistake in the specific name, and in the number (15) of Drummond's exsiccatæ. *B. brevipes* was distributed as No. 16.

Jæger in his Musci Cleistocarpi, p. 36 (1869), cites this variety also as a synonym of *B. brevipes*, and adds *B. Drummondii* Hpe. in Sched., citing the specimens distributed in S. & L. Musci Bor. Am. No. 45, which were issued as *B. brevipes* Hook.

Jæger's Herbarium contained two sets of S. & L. cited above, and another specimen of *B. brevipes* from South Carolina, sent him by Dr. Döring, which are correctly named. The other two specimens are labelled "*B. brevipes* Sch." One is from Florida, "Ex. herb. C. Müller, 1865;" they are not *B. brevipes*, but seem referable to *B. curviseta* L. & J., and are probably the specimens described as var. *minor* by Müller, as the localities are the same. The other specimen, labelled "*B. brevipes* Sch.," has been corrected in Jæger's handwriting to "*B. flexuosa* C. M. var. *minor*," and these specimens are *B. brevifolia* Sull. They were collected in South Carolina and sent to Jæger by Schimper from the herbarium of Dr. Swartz, 1862.

It will be seen from the original description and this mixture of specimens that we do not yet know what the var. *minor* is, and Dr. Müller is the only one who can tell us. According to the Jæger Herbarium it may antedate either *B. curviseta* L. & J. or *B. brevifolia* Sull., though we are more inclined to think it is the former. According to Jæger's Musci Cleistocarpi, it has priority of 20 years over *B. Drummondii* Hpe., which replaces *B. brevipes* Hook. & Wilson. The original description is absolutely useless in trying to place the specimens, but under the description of *B. flexuosa* he cites Drummond's No. 15, which was distributed as *B. Vogesiaca* var. This specimen in our set contains three species, *B. Drummondii* Hpe., *B. brevifolia* Sull. and *B. curviseta* L. & J.

BRUCHIA SETIFOLIA Jæger.

Sporledera setifolia Wilson (?) in Jæger, Musci Cleist. 35 (1869).

Bruchia setifolia Jæger Adumbratio 1: 224 (1878).

The following is the original description which, as will be shown later, must be credited to Jæger solely, as Wilson is cited with a query, and the specimens and notes in his herbarium, indicate that Jæger was mistaken in crediting this species to him.

> 7. *S. setifolia* (Wils.) habitu præcedenti similis; foliis e basi angustiore longe setaceis nervo latissimo instructis, toto fere margine erose dentatis, capsula elliptica breviter apiculata, calyptra lævi.
>
> *Bruchia setifolia* Wilson in Sched.?
>
> Patria. In Louisiana Americæ septentr. collegit cl. *Drummond.*

It will be noted that the description begins by referring to the previous species, which is *B. Ravenelii*, from which this one differs principally in the smooth calyptra, and the longer, narrower leaves with the margins erose dentate. It does not state whether the seta is short or exserted, but we are to infer that it is the former as in *B. Ravenelii.*

In the Manual on page 46 under *B. flexuosa* we find *Sporledera setifolia* Jæger cited as a synonym of *B. microcarpa* Wils. and Drummond's Musc. Amer. Coll. II., No. 14, and both referred as var. *microcarpa* Wils. to *B. flexuosa.* This is undoubtedly an utter impossibility, as will be seen by comparing Jæger's original descriptions in the Musci Cleistocarpi, as given above. *B. microcarpa* may be, as it is placed next to be *B. flexuosa*, but *B. setifolia*, it is expressly stated, belongs to the acaulescent species, which he grouped under *Sporledera.*

Being curious to learn what connection W. Wilson had with this, though only a manuscript one, I wrote to the authorities at South Kensington, and received the following reply frcm Mr. Anthony Gepp:

"In answer to your queries about *Bruchia setifolia* and *B. microcarpa* of Wilson, I may say at once that they are identical, and that Jæger is responsible for spreading confusion concerning them. In Wilson's Herbarium there are specimens and drawings marked '*Bruchia microcarpa* Mss. W. W. (*B. setifolia* in litt. ad T. P. James, February 1855), Louisiana, 43.'

"I have made a fresh drawing from typical specimens and enclose a tracing, from which you can draw your own conclusion as to its claim to rank as a species or not. 'Louisiana, 43,' given above are Drummond's locality and collecting number. You now see why T. P. James put *B. setifolia* as a synonym of *B. microcarpa.* Wilson may at one time have referred the plant as a variety to *B. flexuosa*, but at that time he had not broken up *B. flexuosa* in the liberal way that the moderns have done with their better microscopes. You see that the calyptra is rough and the seta short. Jæger's specimen's of *B. setifolia* apear to have been the right plant."

In the Jæger Herbarium there is a specimen labelled "*Bruchia setifolia* Wils. Louisiana, Drummond," without the number of the original set or the name under which it was distributed. These specimens are not very satisfactory, for there are but two capsules, and these had fallen off. No calyptras are preserved, and the seta is so short, or lacking, that only the vaginule remains, so that the capsules appear to have been sessile. The plants are short, less than 3 mm. high, acaulescent, autoicous, the antheridia in basal buds. The leaves are setaceous and secund, 2 mm. long, serrate at apex, smooth on the back or with very slightly protuberant walls. The spores are .032 mm. and distinctly reticulate. The capsules are minute, less than 1 mm. long, ovoid apiculate, with a rounded base and no neck.

We have not been able to place them satisfactorily in any of the species which we now recognize on account of their incomplete state, but we cannot agree with Lesquereux and James in referring them to *B. flexuosa* as a variety, for that species has a distinct stem, and is not autoicous. We think it is more likely to be *B. Drummondii* Hpe. (*B. brevipes* Hook. & Wils.), with which it agrees in being autoicous and acaulescent, and in the reticulate spores, but differs in lacking the short truncate neck, so characteristic of that species. We do not agree with Mr. Gepp in thinking that they are the same as Wilson's specimens, for the description calls for a smooth calyptra and his were rough.

We had thought it possible that it might be *Sporledera palustris*, as that species had a short truncate base to the capsule, without the inflated neck so characteristic of the *Bruchias*, but these specimens are autoicous, whereas *S. palustris* is paroicous and the spores are warty.

BRUCHIA MICROCARPA Wilson in Jæger, Musci Cleist. 37 (1869).

B. flexuosa var. *microcarpa* L. & J. Manual 46 (1884).

The original description given by Jæger, of which the one in the Manual is a translation, reads as follows:

> "Gracillima; foliis e basi latiore angustissime subulatis, nervo lato percursis, toto margine obsolete denticulatis, capsula gracile eleganter pyriformi, longius apiculata, apiculo erecto, pedicello elongata, calyptra tenera lævi.
>
> "*Bruchia microcarpa* Wils. in litt.
>
> "*Patria.* In Louisiana clar. Drummond collegit."

The specimens in Jæger's Herbarium are labelled "*Bruchia microcarpa*, Wilson; Louisiana, Drummond," without any number or indication of what they were called in Drummond's Mosses. They have been examined and compared with other species and agree with *B. brevipes*, distributed in Drummond's Mosses as No.

16, but not with the description cited above. The description of the pedicel as elongated would seem to preclude this. The only other species, then, to which this description seems to fit, would be *B. curviseta* L. & J. This species occurs in several sets of Drummond's Mosses under No. 15, from which it was described and is the only one of Drummond's which had not been definitely named, by number, when the Manual was issued in 1884. It agrees with the description in its small capsules, which are pyriform and exserted on a long pedicel, and also long apiculate, with a smooth calyptra. It is very probable that this species will prove to be Wilson's lost species. We cannot be certain of this, however, as the number cited for *B. microcarpa* by Lesquereux and James is No. 14 of Drummond's Southern Mosses. In our set, which was formerly the property of G. J. Lyon, and came to us recently from South Kensington, on No. 14, there is pencilled above the name under which it was distributed "*B. flexuosa* var. *microcarpa*." These specimens have been examined and agree with *B. Sullivanti* Aust. It therefore seems as if *B. microcapa* Wilson would remain uncertain, as we learn from Wilson's Herbarium at South Kensington that his specimens are *B. Ravenelii.* It is probable that Wilson sent Jæger the specimens preserved in his Herbarium, as he credits the species to Wilson "in litt." in which case it would become one of the synonyms of *B. Drummondi*, this name having priority of place in Jæger's Musci Cleistocarpi; but if it should prove to be the same as *B. Sullivanti* or *B. curviseta* it would replace these names, over which it has priority.

Bruchia Hampeana C. Müller, Syn. Musc. 1: 18 (1849).
Sporledera Schwægrichenii Hpe. in litt. fide Müller l. c.
Bruchia Schwægrichenii Jæger, Musci Cleist. 36 (1869).

The description given by Müller refers only to the Chilian specimens sent him by Hampe from Herb. Schwægrichen, and he cites no North American locality for this species. In a postal card dated March, 1893, he says:

> "*Br. Hampeana* Chilensis in America septentrionalis non occurrit."

On consulting Jæger's description of *B. Schwægrichenii* I find he cited *B. Hampeana* Müller as a synonym, and besides the original Chilian locality says, "in Louisiana cl. Drummond collegit." A comparison of his description of *B. Schwægrichenii* with that of *B. Hampeana* in Lesquereux and James' Manual shows the latter to be a direct translation of the former, and they simply followed Jæger in crediting this species to North America. We have found in the Jæger Herbarium two specimens labelled *B. Hampeana*, collected in Louisiana, one sent to him by Sickenberger, the other by Count Solms. They are both referable to *B. Drummondii* Hpe. (*B. brevipes* Hook. & Wils.), but they are labelled "*B. Hampeana* Sch." This would seem to indicate that there is a name of Schimper's for a North American species which is identical with the name of the Chilian species, but we have not traced this out, it having no bearing on the name. *B. Schwægrichenii*, in Hampe's Herbarium, is also from Chili. It seems evident, then, that Jæger was mistaken in crediting this species to North America. I have not learned whether there are any specimens preserved in the Lesquereux Herbarium of this species, but in a footnote in the Manual they say of the specimens from Louisiana (Drummond) referred to it, that they differ from *B. Ravenelii* "especially in the distinct somewhat long neck of the capsule." It may be that they had specimens of *B. Carolinæ* Austin, which is closely related to *B. Ravenelii*, and differs in this way also. Sullivant says in the Mosses of the United States, page 17 (1856), that *B. Ravenelii* is "very near the Chilian *B. Hampeana* C. Müll."

SPORLEDERA Hampe, Linnæa, 279 (1837).

Char. gen. Theca clausa, calyptra grandis mitræformis vel campanulata integra, "Habitat, propre Baltimore, Americæ Septentrionalis, socie *Phasci subulati*, Schreb. legit. Beyrich, Mai 1833."

This is the description which follows:

Muscus flavescens, *Phasco subulato* simillimis; foliis inferioribus ex basi latiore subulatis nervosis, perichætialibus latioribus et longioribus, complicatis integerrimis secundis vel flexuosis. Capsula oblonga erecta pedunculata, calyptra campulata eam includente.

Then he says: "At first I thought it must be *Phascum flexuosum* of Muhlenberg, but a comparison with Hedwig's specimens in the herbarium of Prof. Schwægrichen, through the kindness of Prof. Kunze, of Leipzig, contradicts this. With *Bruchia*, this Phascaceous moss is not to be united, as it shows an entirely different structure, also it has a multifid calyptra. Our moss has the structure of *Phascum subulatum*, but is so different in the stalked, elongated capsule, and the campanulate calyptra, that I dedicate it to my friend Herr Sporleder, etc."

It will be seen from the above remarks that Hampe was laboring under a mistake when he contrasted the calyptras of *B. flexuosa* with his *Sporledera Beyrichiana*, due to the fact that there is a a mixture in Schwægrichen's Supplement, in the figure of the calyptra of *Phascum flexuosum.* Furthermore, a part of the type specimen from Hampe's Herbarium is preserved in Sullivant's Herbarium, and although they are immature, yet there is no doubt that it is a species of *Bruchia*, closely allied to the type species of the genus *B. flexuosa*, which antedates *S. Beyrichiana* by fourteen years.

The other species, *B. palustris* (Br. & Sch.) C. Müll., which, according to Müller (Syn. Musc. 1: 19, 1848), was admitted to this genus by Hampe (in litt.), and is so maintained by Limpricht (Rab. Kryptfl. 4: 204), must either be given a new generic name, or merged into *Bruchia.* The absence of the characteristic neck of *Bruchia* would seem to justify its generic rank; the lobate calyptra throws it out of *Pleuridium*, where Schimper placed it, though it is more liable to be mistaken for *P. subulatum* than for any species of *Bruchia.*

The original description of *Sporledera*, calling as it does, for a "large" calyptra, enclosing the capsule, makes it doubtful whether *Phascum palustre* can be included in this genus. Furthermore, it is a question whether a genus can be maintained for a species subsequently referred to it, when the original species and characters of the genus are referable to an older genus.

Notes on some Exoasceæ of the United States.*

By George F. Atkinson.

Material has accumulated from several years collecting which led me to begin the preparation of a paper on the prunicolous species of the *Exoasceæ* of the United States. Unexpectedly a number of new species came to light when the critical study was made. This paper, which is now in press, will present numerous illustrations both of the deformities caused by these fungi in their hosts and of the structure of the various species of the parasites. It has seemed advisable to present in the BULLETIN some notes on these species, with descriptions of those which are considered new. I anticipate there will be some criticism of the disposition which I have made of certain forms, and I beg those who feel thus disposed to withhold a final judgment until the illustrated paper shall appear. There will be given a fuller discussion of the grounds for this arrangement, as well as careful camera lucida drawings, all to the same scale, so that a better defense of my position will then appear than could possibly be given in these notes.

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* I wish to acknowledge my indebtedness to Prof. Thomas Meehan, Prof. L. H. Pammel, Mr. J. B. Ellis, Prof. A. B. Seymour and Mrs. Flora W. Patterson, for favors mostly in the communication of material of some of the prunicolous species.

EXOASCUS DEFORMANS (Berk.) Fuckel.

In the arrangement which I have proposed of the forms occurring on leaves this species occurs only on the leaves and shoots of the peach, *Amygdalus Persica*.

EXOASCUS PRUNI Fuckel.

Exoascus Pruni, as I understand it from the material at hand, occurs only on the fruit of *Prunus domestica* L. in the United States.

EXOASCUS INSITITIÆ Sadebeck.

To this species I would refer the specimens collected by Seymour at Temple, N. H., June 16, 1888, on the leaves of *Prunus Pennsylvanica* L. See Seymour and Earle, Economic Fungi, no. 15. The specimens to which I have had access show several small twigs curved to one side growing from the end of a larger one. The twig has very much the appearance of a small "Witches' Broom." The young twigs are pale and slender, the leaves slightly and finely folded or wrinkled, and the under surface is greyish-white in color from the asci. These characters, together with the size of the asci and the relative size of the asci and stalk-cells agree, it seems to me, with Sadebeck's* species as he describes it on *Prunus insititia* L. and *P. domestica* L.

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*Unters. u. d. Pilzgattung *Exoascus*, etc. Ab. a. d. Jahrb. d. Hamb. Wiss. Anst., 113. 1884.

Kritische Unters. u. d. durch *Taphrina*-Arten, etc. Ibid, 8: 27. 1891.

Die parasiten Exoasceen. Ibid, 10: 2, 48. 1893.

Exoascus Cerasi (Fuckel) Sadebeck.

To this species I refer the specimens collected at Germantown, Pa., on "escaped cherry trees," by Prof. Meehan, and distributed as *Exoascus Wiesneri* Rathay, in Ellis' N. A. F. no. 2286. It forms "Witches' Brooms" and agrees in all essential characters with Sadebeck's characterization of this species which occurs on *Prunus Avium* L. and *P. Cerasus* L. in Europe. Prof. Meehan writes me that the cherry trees from which the specimens were gathered are *P. Avium* L.

Exoascus communis Sadebeck.

This occurs on the fruit of *Prunus maritima* Wang., forming "pockets" (Dartmouth, Mass.), *P. pumila* L., *P. nigra* Aiton (Alma, Mich.), and *P. Americana* Marshall (Seymour and Earle, Economic Fungi, no. 13, Madison, Wis.). It differs slightly from *E. Pruni* Fuckel, the asci being quite regularly clavate and the stalk-cells proportionately more slender, pointed below, and according to Sadebeck (l. c.) they do not intrude between the cells of the epidermis.

Exoascus Farlowii Sadebeck.

This deforms the fruit and floral envelopes of *Prunus serotina* L. According to Sadebeck (l. c.), the asci are not crowded but separated from each other. In the examination of a large amount of material from different parts of the United States, I have rarely found this to be the case. There are, however, other characters mentioned by Sadebeck which make it a good species.

Exoascus confusus n. sp.

This name I have proposed for the species which deforms the fruit and floral envelopes of *Prunus Virginiana* L. A study of the structure of the fungus has convinced me that it is specifically distinct from *E. Pruni* on *P. domestica*. The asci on the fruit of *P. domestica* I have found, in the specimens examined, constantly more slender, and the stalk-cells also more slender proportionately than those on the fruit of *P. Virginiana*. These are 30–45 μ long by 8–12 μ in diameter. The stalk-cells are 15–30 μ long by 6–10 μ in diameter; they are nearly or quite the same diameter as the asci and are proportionately longer than those of *E. Pruni* on *P. domestica*. The proportion between these two structures is more nearly the same as that existing in the case of the *E. Farlowii* Sadeb. on *P. serotina*, while the asci and stalk-cells of *E. Pruni* Fuckel on *P. domestica* are more nearly related to those of *Exoascus communis* Sadeb. on *P. maritima, pumila, nigra*, etc. This is what we would naturally expect since *P. Virginiana* and *P. serotina* belong to a different section of the genus *Prunus* than do *P. domestica*, etc. The physiological influence of the fungus on the fruit of *P. Virginiana* is also different from that of *E. Pruni* on *P. domestica.* The floral envelopes are constantly subject to hypertrophy and also bear asci, in which respect it also agrees with that on *P. serotina* and differs from that on *P. domestica.*

EXOASCUS LONGIPES n. sp.

This species has been found at Danby, near Ithaca, N. Y., producing "pockets" in the fruit of *Prunus Americana* Marshall. It is related to the *E. Pruni* and *E. communis* types, but differs in the long stalk-cells which are strongly intruded between the cells of the epidermis. The asci are 30–40 μ long and 7–10 μ in diameter. The stalk-cells are 25–35 μ high by 3–5 μ in diameter, being usually much narrower below. The lower ends of the cells of the hymenium begin quite early to intrude themselves between the epidermal cells.

EXOASCUS DECIPIENS n. sp.

This has been collected at Ætna and Danby, N. Y., on the leaves of *Prunus Americana* Marshall. It sometimes produces isolated, open, shallow pockets in the leaves, but more frequently attacks a large part of the bases of expanded leaves, where it throws the leaf into a series of fine, irregular folds. On the lower side of the leaf the asci are scattered or rather loosely aggregated in groups. The asci are 20–40 μ long by 7–10 μ in diameter. The stalk-cells are 6–13 μ high by 7–12 μ in diameter, and are usually rounded below. The spores are oval or broadly elliptical, and 3–4 μ in diameter. Conidia are frequently developed, while still in the ascus, by budding.

The shoots are also attacked, and sometimes enlarged, though I never have seen the asci on them. Sometimes the young leaves are attacked and killed without the development of any asci and become black and crisp, and the bases of the larger leaves which bore the asci also become blackened. This also extends into the ends of the affected shoots.

EXOASCUS DECIPIENS SUPERFICIALIS n. var.

The half developed fruits of *Prunus Americana* Marshall are sometimes affected on the surface with a species of *Exoascus* which may prove to be a distinct one, but for the present it seems best to place it as a variety of this species, especially since the specimens were found on one of the same trees, though not in close proximity to the affected leaves. While the mycelium is found rather scantily to some depth in the tissues of the fruit, the stone appears to be normally developed, or at least not absent. The asci are 25–30 μ long by 8–11 μ in diameter, and the stalk cells are very short. Farther study is necessary to determine the limits of the characters.

EXOASCUS MIRABILIS n. sp.

The distorted young buds and shoots of *Prunus angustifolia* Marshall, the Chickasaw plum (*P. Chicasa* Michx.), I have used as the type of this species. It occurs in the Southern States and some of the Western. I have observed it for three years (1890–92) in Alabama (and in S. C. in 1889),* where it sometimes produces serious injury both to wild and cultivated varieties. The buds become transformed into a large clavate or ovate mass of tissues, which is usually hollow within and much resembles the tissues of the plum "pockets," caused by *E. Pruni.* The surface of these hypertrophied buds is covered with the asci. The asci are slightly clavate, rounded or truncate at the free ends, are 25–45 μ long by 8–10 μ in diameter. The stalk-cells are 10–18 μ high by 5–8 μ in diameter, are usually rounded or truncate at the base, and do not intrude between the cells of the epidermis. The spores are quite regularly elliptical. To this species I also would refer specimens from Iowa, communicated by Prof. Pammel, on the buds of *Prunus hortulana* L. H. Bailey, a closely related species, and upon *P. Americana* from the same place.

EXOASCUS MIRABILIS TORTILIS n. var.

On the fruits of the Chickasaw plum, *P. angustifolia* Marshall, in the Southern States, the fruit is frequently distorted by a fungus which I take to be of the same species as the one on the buds. All the essential characters are the same, but the asci and stalk-cells seem to be on the average a little longer, probably due to the greater amount of nourishment which the fruit provides. In the specimens examined the entire fruit is not affected as in the case of *E. Pruni* and related species, but only one side, sometimes only a small portion of it. Only one side then is hypertrophied and may appear as a large wart, or the fruit may be curved and variously twisted. Rarely does it form a "pocket." In order to avoid possible confusion, I have thought it well to distinguish this fruticolous form as a variety.

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* Erwin Smith reports it from Maryland and Georgia, Journ. Myc. 6 : 108.

The fruits of cultivated varieties of *P. Americana*, in Iowa, appear to be somewhat similarly distorted, and with the examination I have made, they, as well as the asci, etc., seem to be more nearly related to this form than to *E. communis* Sadebeck, but I should prefer to reserve a decision until further observation is at hand as to the relation of these fruits to the deformed buds of *P. Americana*.

EXOASCUS RHIZIPES n. sp.

This interesting species I have found upon the Japan plum, *Prunus triflora* Roxburgh. I collected it at Auburn, Ala., in May, 1892. It deforms the buds and fruit very much as *E. mirabilis* Atkinson, does those of *P. angustifolia*, but the structure of the fungus is quite different. It is more closely related to the *E. longipes* Atkinson on the fruit of *P. Americana* Marshall. From this it differs in the still longer stalk-cells which intrude farther between the cells of the epidermis, and especially in the possession of numerous rhizoids which grow not only from the stalk-cells, but also from the lower portion of the asci. The form of the plant on the fruit I have used as the type of the species. Here the asci are 30–40 μ long by 8–10 μ in diameter. The stalk-cells are 25–40 μ long and 3–5 μ in diameter, tapering much below. In very thin sections the lower part of the hymenium, from the numerous rhizoids which branch off at all depths, appears as a cellular tissue from which the asci arise.

The form on the bud is similar, but the rhizoids are not as long nor as numerous, but still much more so than in *E. longipes*. These characters with the different physiological effect produced on the host seperate it from that species.

EXOASCUS VARIUS n. sp.

As the type of this species I have used the *Exoascus* on the leaves of *Prunus serotina* L., which I have collected very abundantly in Alabama. It is usually referred to *E. deformans.* It appears to me to be clearly distinct from that species, and to approach nearer in the relative proportion of the stalk-cells and asci to the species on the fruit of *P. serotina*, viz. *E. Farlowii* Sadeb. The asci are 20–27 μ long by 8–10 μ in diameter, and the stalk-cells 12–17 μ high by 8–10 μ in diameter. These measurements are taken from specimens which represent the longest stalk-cells. There are great variations and frequently the stalk-cells are only one-fourth as long as the entire fruit body, instead of one-third as long. The asci occur on both sides of the leaves.

The fungus quite frequently deforms the same shoots on which the affected leaves are borne, but there is no tendency, so far as I have observed, to form "Witches' Brooms." Specimens of this were distributed by Seymour and Earle, Economic Fungi, no. 128, as *Taphrina deformans* (B.) Tul. What I take to be the same was distributed in Ellis' N. A. F. no. 2285 b. as *Taphrina Pruni* (Fuckel), from Missouri. I have specimens from Smyrna, Del., communicated by Ellis, and it occurs in other places.

Rather scanty specimens on the leaves of *Prunus demissa* Walp. from Ute Pass, Colorado, ex herb. Trelease, communicated by Prof. Pammel, I have referred to this species with some doubt.

EXOASCUS CECIDOMOPHILUS n. sp.

This is another very interesting species which I collected near Ætna, N. Y., July 6, 1894, and other places. It occurs on galls formed by the larvæ of some cecidomid on the fruit of *Prunus Virginiana* L. The greater part of the hypertrophy is controlled by the larvæ of the cecidomid. The fungus is mostly superficial, the mycelium being scanty and not penetrating very deep. The deformed fruits are two to four times longer than the normal ones and slightly broader. The ends are rounded, the middle a little inflated, a slight strong constriction near the base which appears to flare out, and in doing so, gradually appears to break away from the receptacle at one or more points and thus opens the gall. The tissue of the gall is quite hard as compared with that of the hypertrophied fruits caused by *E. Pruni* and related species. The hollow interior is comparatively smooth, and in the apex of this several of the larvæ of the cecidomid are bunched.

The fungus appears only to attack a portion of the surface. These portions are then still more swollen and cause the gall to be quite strongly curved. The asci are cylindrical or rarely clavate. They are 30–40 μ long by 6–10 μ in diameter. The stalk-cells are very broad and rounded below, being 6–10 μ high by 10–15 μ in diameter.

Further study is needed to determine just the relation which the cecidomid bears to the fungus. At the present writing I do not think that the fungus occurs on all of the fruits which are deformed by the insect.

Besides these prunicolous species of Exoasceæ two others worthy of note have been collected by myself in the Southern States. One of these proves to be undescribed.

EXOASCUS AUSTRALIS n. sp.

This was collected at Auburn, Ala., April 30, 1892, on the leaves of *Carpinus Americana* Michx. It attacks only the leaves and does not deform "Witches' Brooms," as does *Exoascus Carpini* Rostrup, upon *Carpinus Betulus* in Europe. It is in other respects very different.

Usually nearly the entire leaf is affected and strongly arched upward, giving it a rude, boat-shaped appearance. There are also separate archings between the larger lateral veins which thus throw the surface into a series of strong folds. The upper surface of the leaf is bright red until it begins to die, when it turns brown, then black, then falls away.

The asci are borne only upon the upper surface, in so far as I have observed. They stand closely crowded together They are mostly cylindrical, and 50 μ long, but sometimes vary from 30–60 μ long. The usual diameter is from 7–8 μ, but sometimes they become even 10 μ, where they are not very much crowded. The ends are truncate. They lack a stalk-cell, but frequently the base is more or less abruptly narrowed into a short stalk-like base. The spores are round and measure 4–5 μ in diameter. The mycelium is subcuticular only, not penetrating into the tissues of the leaf.

TAPHRINA AUREA (Persoon) Fries.

This species was collected at Columbia, S. C., May, 1889, on the leaves of *Populus monilifera* Aiton. It forms rounded, rather deep, open pockets which arch upwards, the asci being on the concave or under side of the spots. The asci are of the slender kind in the specimens examined, with long narrow stalk-cells. which penetrate far between the epidermal cells. According to Sadebeck this species has hitherto been reported on *P. monilifera* only from Denmark. It is also, I believe, the first recorded occurrence of this species in North America, the specimens which have been heretofore reported as belonging to this species in this country occur on the fertile aments of species of *Populus*, which is entirely different. These specimens on the fertile aments of several species of *Populus* (*tremuloides*, *Fremontii*, *grandidentata*), have been referred by Farlow to *Taphrina rhizophora* Johanson. I have had an opportunity of examining specimens from the fertile aments of *Populus tremuloides* Michx. collected at Ithaca, N. Y., by R. H. Pettit, May 13, 1891. They are certainly *Taphrina rhizophora* Johanson, the asci lacking the stalk-cells, and the narrowed base penetrating 30–40 μ in the tissue of the hypertrophied ovary.

Botanical Notes.

The Systematic Botany of North America has been inaugurated by the distribution of sample pages taken from the manuscript of the Hepaticæ, prepared by Professor Underwood. The board of editors announce the following parts for 1895, but their sequence may be somewhat changed:

Vol. **5**: Parts 1 and 2, Pyrenomycetes by Messrs. J. B. Ellis and B. M. Everhart; Vol. **9**: Part 1, Hepaticæ by Prof. L. M. Underwood; Vol. **10**: Part 1, Typhaceæ, Sparganiaceæ, Naiadaceæ, Juncaginaceæ, Alismaceæ, Hydrocharitaceæ by the late Dr. Thomas Morong; Vol. **11**: Parts 1 and 2, Cyperacæ by Prof. N. L. Britton and Prof. L. H. Bailey.

Index to Recent Literature relating to American Botany.

Bescherelle, E. Musci Centrali-Americanæ in Guatemala, Costa Rica, Columbia et Ecuador a cl. F. Lehmann lectæ. Bull. Herb. Boiss. **2**: 389–400. Je. 1894.

New species are described in the genera *Holomitrium*, *Fissidens*, *Peromnion*, *Brachymenium*, *Prionodon*, *Porotrichum*, *Lepidopilum*, *Microthamnium* and *Hypopterygium*.

Bessey, C. E. Evolution and Classification. Proc. Am. Assoc. Adv. Sci. **42**: 237–351. Reprint issued 6 Jl. 1894.

Vice-presidential address before Section G, at Madison, Wis. 17 Ag. 1893.

Bloomfield, L. M. Contributions to the Life History of the Wheat Plant (*Triticum vulgare*). Ann. Rep. Ohio State Acad. Sci. 2, 12–14. 1894.

Brandegee, Katharine. Studies in *Ceanothus*. Proc. Cal. Acad. Sci. (II.) **4**: 173–222. 2 Je. 1894.

Briquet, John. Rectifications de Nomenclature. Bull. Herb. Boiss. **2**: 439, 440. Je. 1894.

Accepts the genus *Ramona* Greene as prior to *Audibertiella* Briquet, and transfers to it all the species of *Audibertia* Benth.

Brotherus, V. F. Musci Schenckiana. Hedw. **33**: 127–136. 20 Je. 1894.

Contribution to the Moss-flora of Brazil.

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Claypole, E. W. Cryptogamic Flora of Summit County. Am. Rep. Ohio State Acad. Sci. 2, 40. 1894.

List of species without localities.

Claypole, E. W. Grasses of Summit County, Ohio. Ann. Rep. Ohio State Acad. Sci. 2, 46. 1894.

Clements, Frederick E. A preliminary List of the Botanical Expeditions in Nebraska, 1803–1893. Bot. Surv. Neb. 3, 39–42. 18 Je. 1894.

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Coulter, John M. A Manual of the Phanerogams and Pteridophytes of Western Texas. Contr. U. S. Nat. Herb. **2**: pp. 588. 1892–1894.

A descriptive flora of the region, the Juncaceæ by F. V. Coville, *Carex* by L. H. Bailey, Gramineæ by L. H. Dewey, and Pteridophyta by L. M. Underwood.

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Davy, J. Burtt. Contribution to the History of *Achyrodes aureum*. Erythea, **2**: 113–119. Jl. 1894.

Foltz, K. O. The phanerogamic Flora of Summit County. Ann. Rep. Ohio State Acad. Sci. **2**, 21–31. 1894.

A list of species without localities.

Goff, E. S. Noxious Weeds. Bull. Wis. Exp. Sta. 39, pp. 40, *pl. 13*. Ap. 1894.

Gives weed law and discusses in particular the Russian thistle (*Salsola Kali Tragus*).

Greene, Edward L. Novitates occidentales—VII. Erythea, **2**: 119–122. Jl. 1894.

Describes *Lupinus fallax*, *L. Michenerii*, *Delphinium Emiliæ*, *Eschscholtzia cucullata*, *Hemitomes pumilum*, *Stachys velutina* and *S. stricta*.

Heald, F. D. Noteworthy anatomical and physiological Researches. Bot. Gaz. **19**: 284–295. 16 Jl. 1894.

The fixation of free nitrogen by plants.

Hooker, J. D. *Houlletia Landsbergi*. Curtis' Bot. Mag. *pl. 7362*. Jl. 1894.

A Costa Rican orchid.

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Masters, Maxwell T. The Cypresses of Monterey. Gard. & For. **7**: 298. 25 Jl. 1894.

Note on *Cypressus macrocarpa*, its distribution and close alliance to *C. Guadeloupensis*.

Meigen, Fr. Biologische Beobachtungen aus der Flora Santiagos in Chile. Trockenschutzeinrichtungen. Engler's Bot. Jahrb. **18**: 394–480. 1894.

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Rydberg, P. A. A Revision of the Nomenclature of the Nebraska Polypetalæ. Bot. Surv. Neb. 3, 20–39. 18 Je. 1894.

Sargent, C. S., Editor. North American Thorns. Gard. & For. **7**: 292, *f. 49.* 25 Jl. 1894.

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Sargent, C. S., Editor. *Phlox divaricata.* Gard. & For. **7**: 255, *f. 43.* 27 Je. 1894.

Sargent, C. S., Editor. *Passiflora manicata.* Gard. & For. **7**: 264, *f. 44, 45.* 4 Jl. 1894.

Sargent, C. S., Editor. The Tupelo, *Nyssa sylvatica.* Gard. & For. **7**: 273, *f. 46.* 11 Jl. 1894.

Schiffner, Dr. Victor. Revision der Gattungen *Bryopteris, Thysananthus, Ptychanthus* und *Phragmicoma* im Herbarium des Berliner Museums. Hedw. **33**: 170–176. 20 Je. 1894.

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Record of *Microsphæra Euphorbiæ* and *M. Russellii* at Columbus.

Selby, A. D. Progress in the Study of the Fungus of the Wheat Scab. Ann. Rep. Ohio State Acad. Sci. 2, 33–34. 1894.

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Describes genus and one species, *P. Californica.*

Smith, Erwin F. Peach Yellows and Peach Rosette. U. S. Dept. Agric., Farmers' Bull. 17, pp. 20, *7 figs.* 1894.

Smith, John Donnell. Undescribed Plants from Guatemala and other Central American Republics.—XIII. Bot. Gaz. **19**: 255–266, *pl. 24–26.* 16 Jl. 1894.

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The genus *Frullania*

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Voorhees, E. B. Crimson or Scarlet Clover, its Growth, Composition and Usefulness. Bull. N. J. Exp. Sta. 100, pp. 32, *pl. 2.* 1894.

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S. Costa-Ricense described as new.

Webster, F. M. Same Notes on Entomophthoreæ. Ann. Rep. Ohio State Acad. Sci. 2, 31–32. 1894.

Record of observations on species of *Empusa.*

Werner, W. C. New Phænogams for the Ohio Flora. Ann. Rep. Ohio State Acad. Sci. 2, 38–39. 1894.

Record of 27 species and varieties, with localities.

Contributions from the Herbarium of Columbia College.

[The numbers omitted from this list are out of print.]

No. 4. A List of Plants Collected by Miss Mary B. Croft at San Diego, Texas. By N. L. Britton and H. H. Rusby (1887), ... 25 cents.

No. 5. New or Noteworthy North American Phanerogams. By N. L. Britton (1888), ... 25 cents.

No. 6. An Enumeration of the Plants Collected by Dr. H. H. Rusby in South America, 1886–1887. By N. L. Britton. (Twenty-three parts published; not yet completed.)

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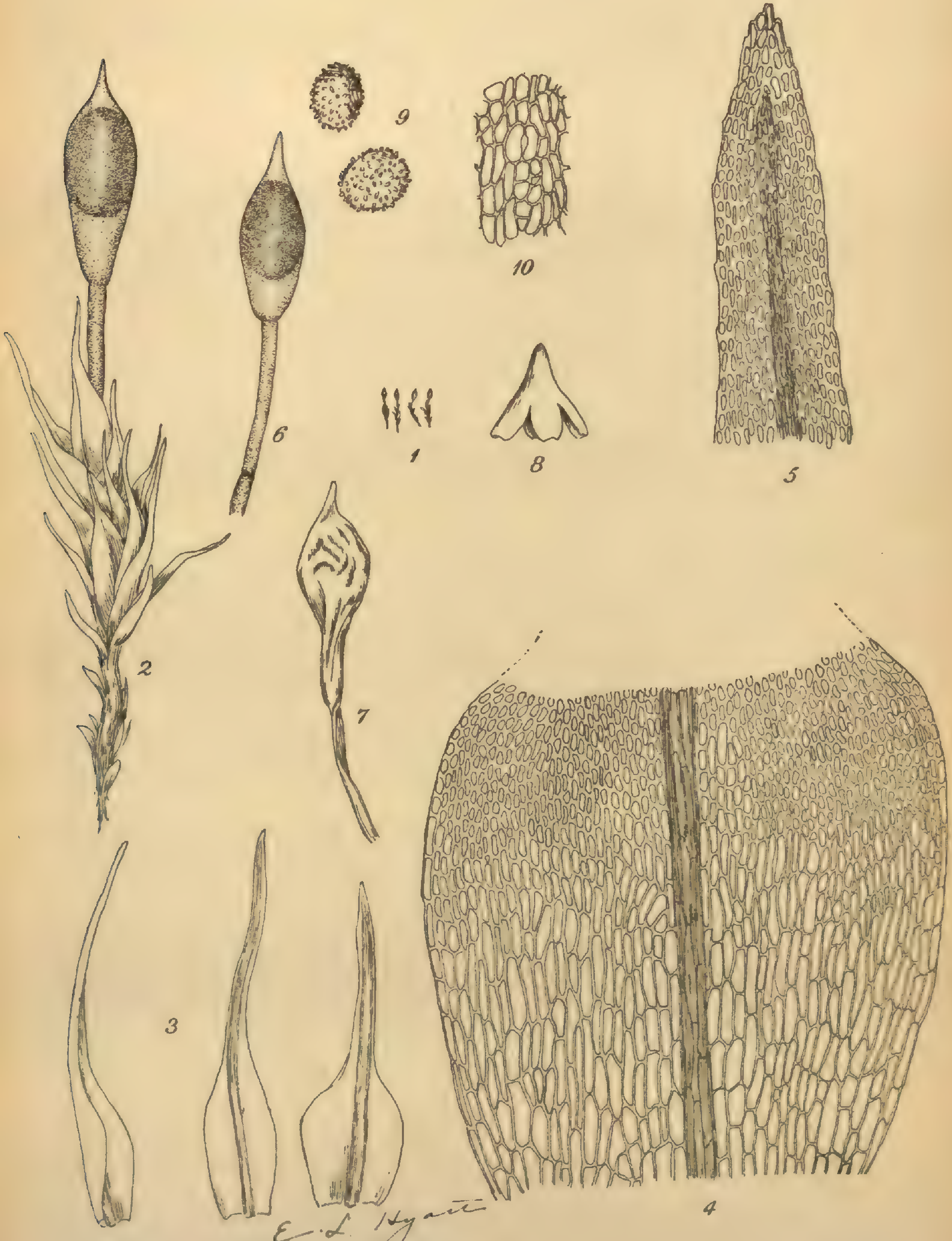
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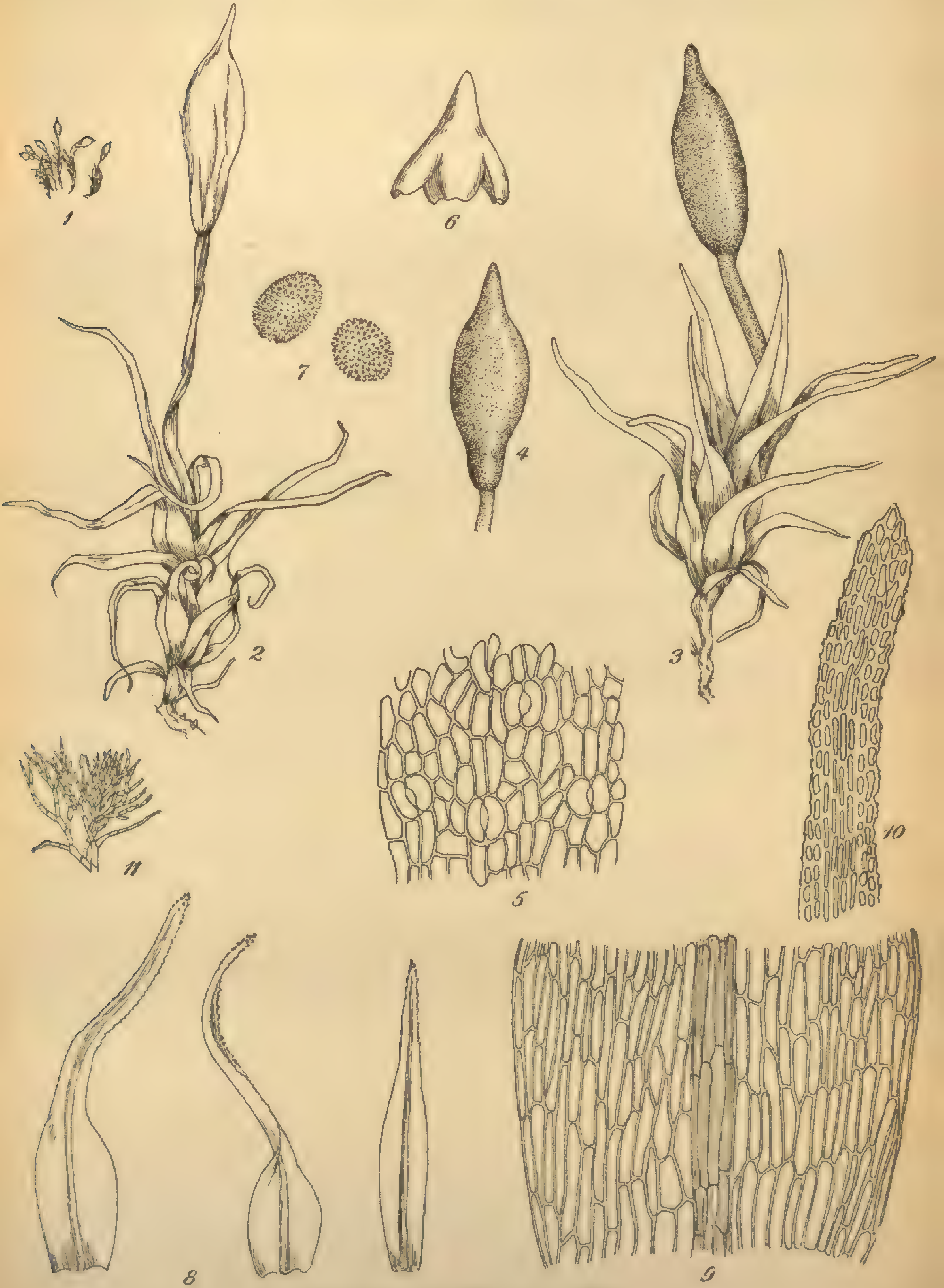
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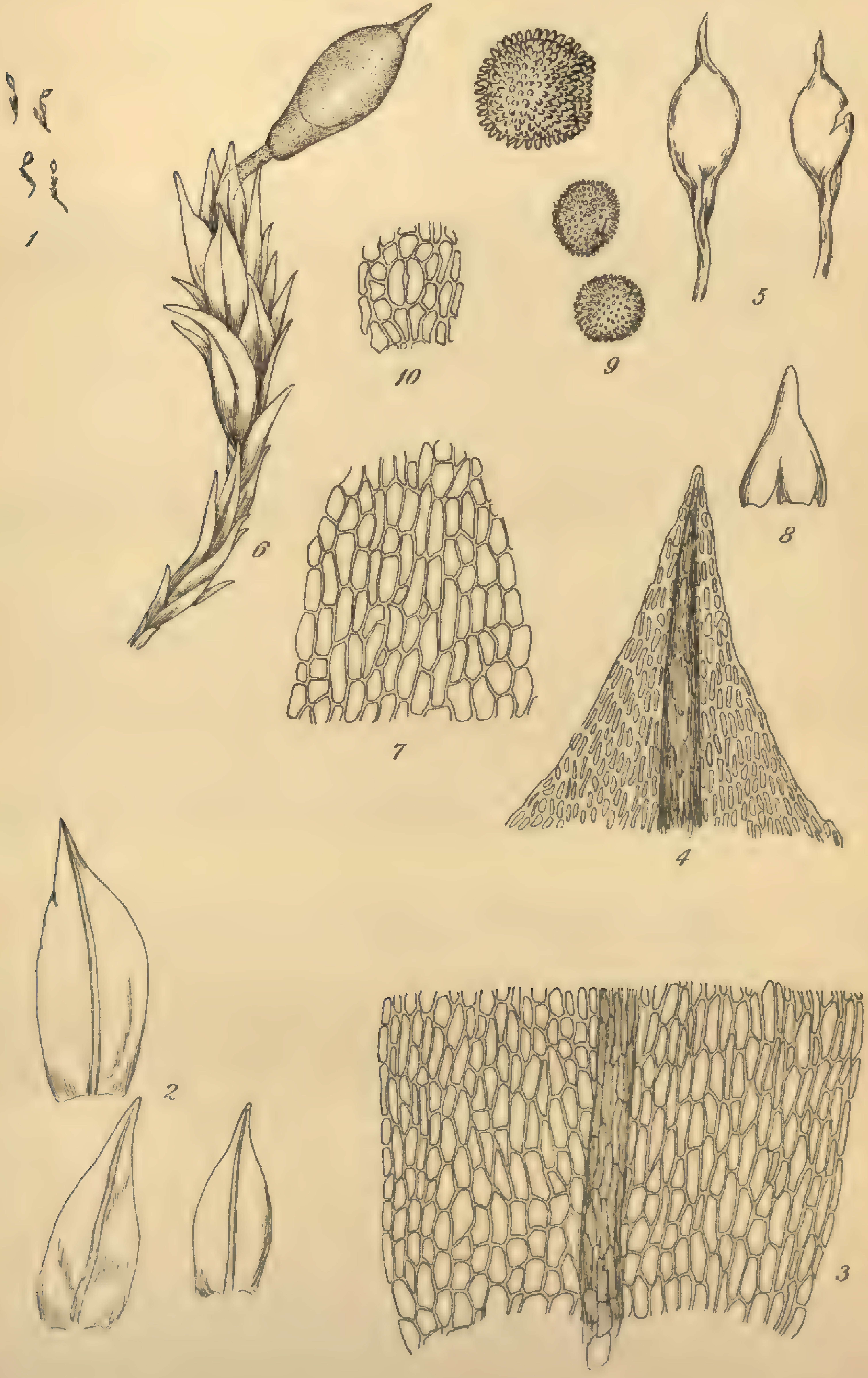
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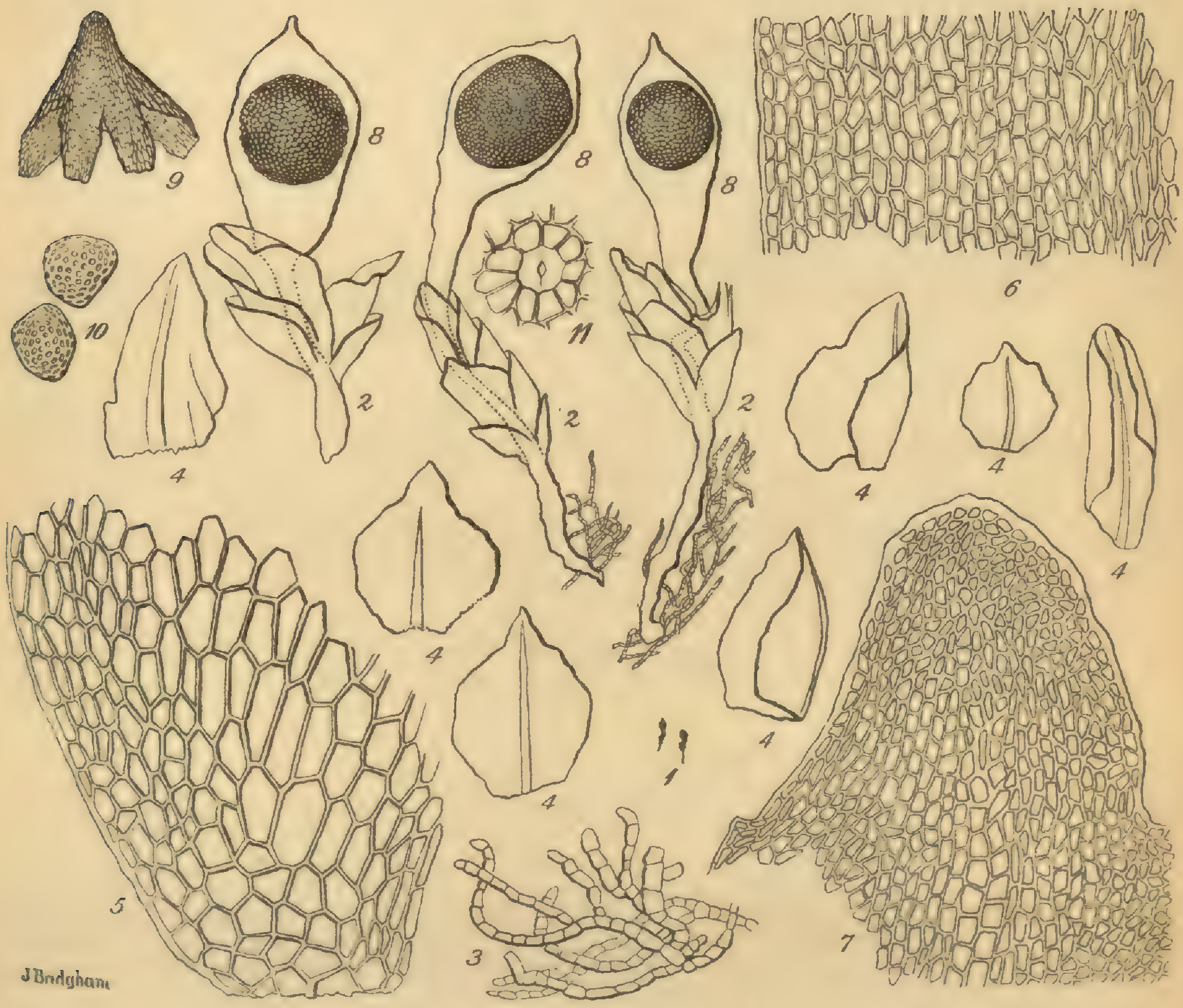
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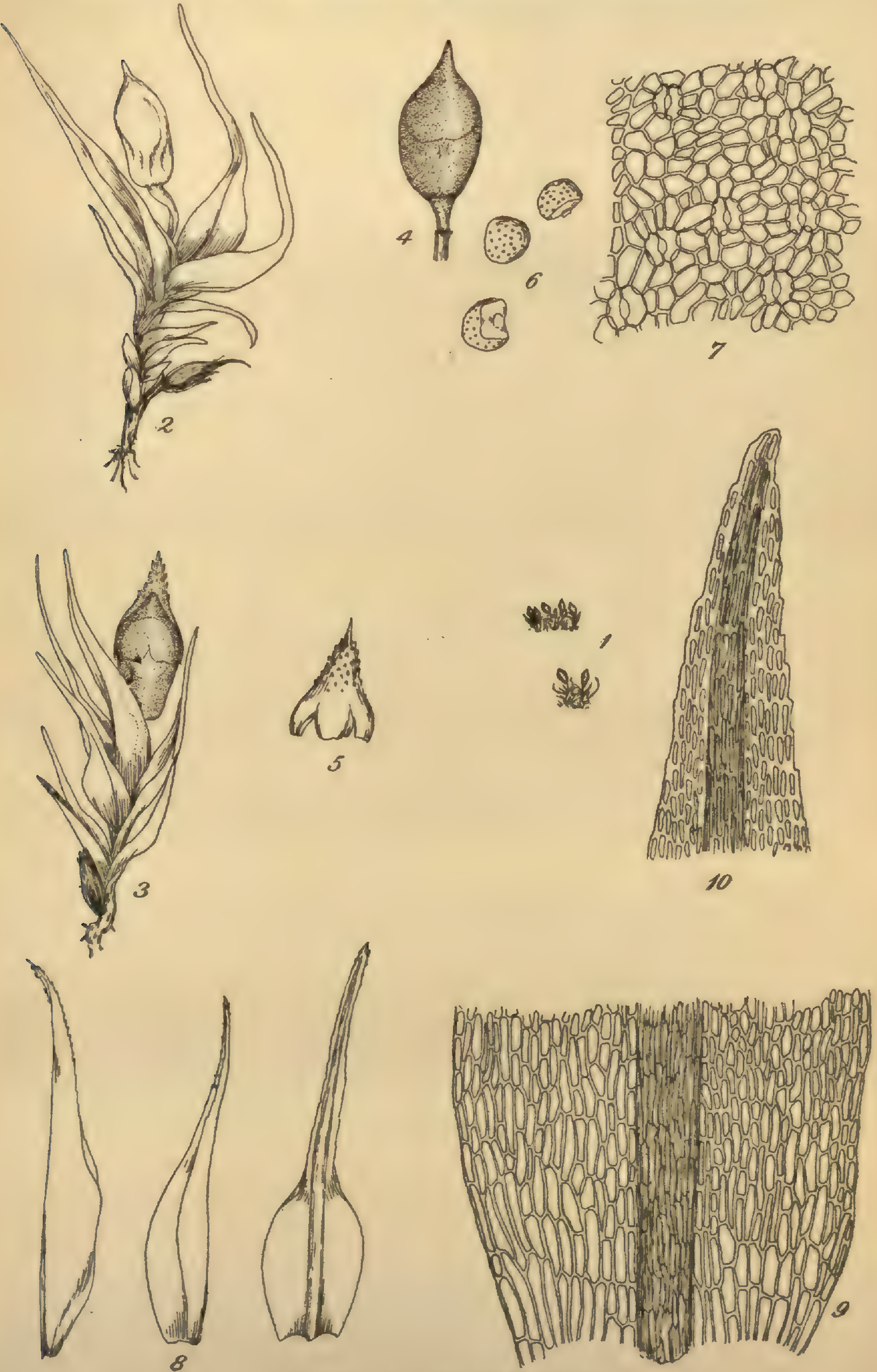
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VOL. 21. SEPTEMBER, 1894. NO. 9.

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OF THE
TORREY BOTANICAL CLUB.

A MONTHLY JOURNAL OF BOTANY.

EDITED BY

NATHANIEL LORD BRITTON,

AND OTHER MEMBERS OF THE CLUB.

CONTENTS:

	PAGE.
Note on *Tubercularia pezizoidea* Schwein. (PLATE 218): *Hermann Schrenck*	385
Contribution to the Lichens of Maine, I.: *F. L. Harvey*	389
Lichens new to North America: *J. W. Eckfeldt*	393
Notes on the Chromatophores of *Astrophyllum sylvaticum* and of some other Plants (illustrated): *Alfred C. Stokes*	396
Proceedings of the Botanical Club, A. A. A. S., Brooklyn Meeting, August 15–22, 1894: *F. C. Newcombe, Secretary*	406
Organization of the Botanical Society of America	411
Titles of Papers presented before the Section of Botany, A. A. A. S., Brooklyn Meeting, August 16–23, 1894	412
Report of the Committee on Bibliography of the Madison Botanical Congress	414
INDEX TO RECENT LITERATURE RELATING TO AMERICAN BOTANY	416

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BULLETIN

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TORREY BOTANICAL CLUB.

Vol. 21. Lancaster, Pa., September 29, 1894. No. 9.

Note on Tubercularia pezizoidea Schwein.

By Hermann Schrenk.

(Plate 218.)

In the "Synopsis Fungorum" (1831)[1] appeared the description of a fungus, collected on poplar logs in New York by Dr. Torrey, to which Schweinitz gave the name *Tubercularia pezizoidea*. The description was as follows: "T. Sporidochiis, fasciculatim confluentibus, maximis, pezizoideis, undulato-plicatis, ex-epidermide prorumpentibus et ad uncialem longitudinem irregulariter confluentibus, pede crasso suffultis, substantia indurato-cornea, strato sporidifero compacto incarnato purpureo, subnitente, sed superficie subpruinosa. Intus albescunt et ætate subpulverulenta evadunt sporidochia. Talis cupula non confluens diametrum plus quam bilinearam habet et Pezizam margine obtuso, undulato plicato disco refert."

This fungus, apparently common in the northern United States, was reported by Hitchcock[2] as *Tubercularia pezizoidea* Schw. in 1829, previous to the publication of the name by Schweinitz, Hitchcock probably having seen some of the Schweinitz specimens. Somewhat later Sprague[3], in cataloging this form from

---

[1] *L. D. de Schweinitz*—Synopsis Fungorum in America Boreali media degentium. Communicated to Am. Phil. Soc. Philadelphia, 15 Ap. 1831.

[2] *E. Hitchcock*—Catalogue of Plants growing within 50 miles of Amherst, Mass. 64. 1829.

[3] *C. S. Sprague*—Bost. Soc. Nat. Hist. **6**: 319. 1858.

Eastern Massachusetts as *Tubercularia pezizoidea* Schw. makes the following note: "This is not a true *Tubercularia*, but is an anomalous and probably immature form of some high order. It is found, however, all over the United States in precisely the same condition, specimens from Lake Superior and Massachusetts do not differ at all." In 1875 in Grevillea,[4] there is a description of a *Hypocrea*, where it is stated that it and the *Tubercularia pezizoidea* of Schweinitz are identical. This was named *Hypocrea Richardsoni* Berk. & Mont. I have been unable to find any note as to Montagne's connection with this species, the paper in Grevillea being by Berkeley, and the earliest one in which the name *Hypocrea Richardsoni* occurs, as far as I have been able to ascertain.

Since then the fungus has been reported under one of these two names by various writers. Cooke[5], and Paoletti[6] give it as *Tubercularia pezizoidea*. Frost[7] uses the name *Hypocrea Richardsoni* in 1869, six years previous to its publication (evidently a manuscript name.) It is mentioned as this furthermore by Tuckerman and Frost[8], Fowler[9], Day[10], Arthur[11], Cobb[12], Kelsey[13], Farlow[14], Peck[15] and Cockerell[16].

In order to determine whether this fungus is a *Hypocrea* or a *Tubercularia*, I examined specimens from various sources. I was

---

4. *M. J. Berkeley*—Notices of North American Fungi. Grev. 4: 14. 1875-76.
5. *M. C. Cooke*—Hyphomycetous Fungi of U. S. Bull. Buffalo Soc. 3: 192. 1877.
6. *Giulio Paoletti*—Revisione del Genere *Tubercularia*. Atti Soc. Ven. Trent. Sci. Nat. 11: fas. 1, Padova. 1888.
7. *C. C. Frost*—Enumeration of New England Fungi. Proc. Bost. Soc. Nat. Hist. 12: 80. 1869.
8. *E. Tuckerman and C. A. Frost*—Cat. of Plants growing without Cultivation within 30 miles of Amherst College. 1875.
9. *James Fowler*—List of New Brunswick Plants. Ann. Rep. Sec. Agr. Prov. N. B. for 1878.
10. *David F. Day*—Cat. of Plants about Buffalo, 161. 1883.
11. *J. C. Arthur*—Report of Botanical Work in Minnesota for 1886. 33.
12. *W. A. Cobb*—A List of Plants found growing wild within 30 miles of Amherst, Mass. 1887.
13. *F. D. Kelsey*—Notes on the Fungi of Helena, Mont. Journ. Myc. 5: 81. 1889.
14. *W. G. Farlow*—Cryptogamic Flora of White Mts. Appalachia 3: 247.
15. *C. H. Peck*—22d N. Y. State Report, 97.
16. *T. D. A. Cockerell*—Notes on Flora of high altitudes in Custer Co., Colorado. Bull. Torr. Bot. Club, 18: 173. 1891.

fortunate in being able to see some of the original Schweinitz specimens and to recognize that they agreed in every way with specimens of Berkeley's *Hypocrea Richardsoni.* (In Herb. Curtis, Russell, Mass. 5870.) Although the external appearance is that of a *Tubercularia*, yet the structure is in no way that of a *Tubercularia.* As to its being a *Hypocrea*, there are to be sure structures which by many have been mistaken for asci and their spores, but which, as will be seen, are of an entirely different nature.

The fungus is scattered over the branches of poplars in tubercular, purplish-red masses, breaking through the epidermis at an early stage. It is attached to the substratum at the centre, is disc-shaped and convex above when young, becoming more or less wrinkled when old. On sectioning a single mass it will be found to consist of a loosely woven mycelium on the inside, the hyphæ of which gradually become parallel, forming a cortex of parallel hyphæ. Into this layer there extend large club-shaped bodies filled with larger and smaller oil-globules ("c" fig. 4.) These bodies are in most cases perfectly club-shaped, but some very irregular forms are met with, branching or swelling at the apex into bodies resembling sporidia. By various authors these bodies have been taken for asci and described as such, but it is evident from their vague and uncertain descriptions of spores that they were not sure of having seen any. More recent writers have always reported the fungus as sterile. (Ellis[17], Peck[18], etc.).

On closely examining the tips of the parallel hyphæ, some of them were found projecting beyond the others, slightly swollen and provided with four distinct sterigmata and spores. In order to see these distinctly, it was found very advantageous to treat the sections for several minutes with potash and employ a high magnification. The fertile basidia are not very numerous, and are difficult to distinguish from the paraphyses, as I would call the parallel hyphæ. The sterigmata are short and have at their tip fuliginous elliptical basidiospores. There is a possibility that the basidia at first have conidia, in fact some of the sterile basidia were constricted at the top as if about to bear a conidium. As to the clavate bodies there is some question concerning their function. They differ from the cystidia of other Hymenomycetes in not being at a level with the basidia in the hymenium, their position in this respect being very constant. Whether or not they function as food receptacles, as might be supposed from their oily contents, it is difficult to say.

---

[17] *J. B. Ellis and B. M. Everhart*—Journ. Myc. **2** : 62. 1886.

[18] *C. H. Peck*—24th N. Y. State Mus. Rep. 103.

An examination of various specimens of *Hypocrea Richardsoni* showed the basidia and sterigmata in most cases. The ones in Ellis, N. A. F., 1329, were particularly good. The Schweinitz specimens of *Tubercularia pezizoidea* had a large number of clavate bodies and sterile basidia. Specimens collected by Dr. Thaxter at Waverly, Mass., and others from Shelburne, N. H., collected by myself this spring, showed the basidia and their spores perfectly.

From all this it appears that the fungus is neither a *Tubercularia* nor a *Hypocrea*, but one of Basidiomycetes and more specifically one of the Hymenomycetes. The basidia are in a hymenium which is perfectly smooth, a character which would place this form among the Thelephoreæ. The absence of setæ, the superior hymenium, the approximately flat and sessile sporophore includes it in my opinion in the genus *Corticium*. The plant would then have to take the name *Corticium pezizoideum* (Schw.) and be characterized as follows:

Scattered or gregarious, purplish-red, breaking through the epidermis, finally centrally attached, margin free, discoid, smooth when young, becoming more or less wrinkled when older. Hymenium smooth; basidia 5.5 μ wide with slightly allantoid fuscous basidiospores 5–7 μ + 1½ μ. Large cystidia-like bodies very numerous, extending into the hymenial layer, generally with numerous oil-globules.

Growing on poplar logs in the colder portions of North America, from New England westward to Colorado and northward.

I would thank Dr. W. G. Farlow for the use of specimens and literature and for his interest and aid offered me in my work.

Description of Plate 218.

FIG. 1. *Corticium pezizoideum* (Schw.) Schrenk. The older ones are wrinkled.

FIG. 2. Section of a young *Corticium*, rupturing the epidermis.

FIG. 3. Section of a mature *Corticium* (magnified), showing the hymenium and the clavate bodies distributed through it.

FIG. 4. A portion of the hymenium more highly magnified; "b," basidia and spores; "c," clavate bodies; "p," paraphyses.

FIG. 5. Irregular forms of the clavate bodies containing oilglobules.
FIG. 6. Basidia with sterigmata and spores (highly magnified).
FIG. 7. Basidiospores.

Contribution to the Lichens of Maine.--I.

BY F. L. HARVEY.

The following list embraces lichens from Maine collected by the Rev. Joseph Blake and found in the Blake Herbarium of the Maine State College, together with species noticed about Orono by the writer, and a few species recorded from Maine in Tuckerman's North American Lichens.

The list includes all the species known by the writer to have been published from the State. No personal efforts have been made to collect these neglected forms beyond what was needed for class work, hence the list from Orono and other parts of the State is far from exhaustive.

Miss Cummings has collected quite extensively during the past season in Aroostook Co., and we understand has detected quite a large number of interesting forms that will swell the State list. The lichens in the Blake Herbarium were largely collected from thirty to forty years ago, those from Mt. Ktaadn bearing date of July 4, 1856. Mr. Blake's correspondence shows that probably all his specimens were determined by Tuckerman. The specimens have withstood the ravages of time much better than the names have the criticisms of systematists.

The synonymy has presented some knotty problems, which we trust have been correctly solved. The modern names only have been given in the list. We desire to acknowledge our indebtedness to Miss Clara E. Cummings for professional courtesies. We would be pleased to correspond with all who have collected lichens or other Cryptogams in Maine, looking toward a catalogue of the Cryptogams of the State. In listing the species we have followed the sequence adopted in Tuckerman's "Genera Lichenum."

Tribe I.—Parmeliacei.

FAM. I.—USNEEI.

1. *Ramalina calacaris canaliculata* Fr. On trees, common. Me. (Blake); Orono (Harvey).

2. *R. pusilla* (Prev.). On trees. (Tuckerm. N. A. Lich. I. 26.) On trees, Me. (Tuckerman).
3. *Cetraria Islandica* (L.) Ach. On ground, common. Mt. Ktaadn (Blake); Orono (Harvey).
4. *C. cucullata* (Bell) Ach. On earth. Mt. Ktaadn (Blake).
5. *C. nivalis* (L.) Ach. Mt. Ktaadn (Blake).
6. *C. Fahlunensis* (L.) Schær. Mt. Ktaadn (Blake).
7. *C. ciliaris* Ach. On trees and rails. N. Yarmouth (Blake); Orono (Harvey).
8. *C. lacunosa* Ach. Mt. Ktaadn (Blake).
9. *Evernia prunastri* (L) Ach. On rails, Me. (Blake); Orono (Harvey).
10. *Usnea barbata* (L.) Fr. Type.
11. *Usnea barbata florida* Fr. Cumberland (Blake); Orono (Harvey).
12. *Usnea barbata hirta* Fr. Cumberland (Blake); Orono (Harvey).
13. *Usnea barbata serotina* Fr. Cumberland (Blake); Orono (Harvey).
14. *Usnea barbata dasypoda* Fr. Cumberland (Blake); Orono (Harvey).
15. *Usnea barbata plicata* Fr. Cumberland (Blake); Orono (Harvey).
16. *U. longissima* Ach. On spruce trees. Greenfield (Harvey).
17. *Alectoria jubata chalybeiformis* Ach. On rails. Cumberland (Blake); Orono.

FAM. 2.—PARMELIEI.

18. *Theloschistes parietinus* (L.) Norm. On stones. Common. Wells (Blake); Orono (Harvey).
19. *T. concolor* (Dicks.) Cumberland (Blake).
20. *Parmelia perlata* (L.) Ach. On stones. Common. Cumberland (Blake); Orono (Harvey).
21. *P. tiliacea* (Hoffm.) Flœrk. Trees and rocks. Cumberland (Blake); Orono Harvey).
22. *P. saxatilis* (L.) Fr. Wells (Blake); Orono (Harvey).
23. *P. physodes* (L.) Ach. Saco (Blake); Orono (Harvey).
24. *P. colpodes* (Ach.) Nyl.; Orono (Harvey).
25. *P. olivacea* (L.) Ach. Common. Mt. Ktaadn (Blake); Orono (Harvey).
26. *P. olivacea sorediata* (Ach.) Nyl. Mt. Ktaadn (Blake). In Blake's Herb. as *P. dendritica* Nyl.
27. *P. stygia* (L.) Ach. Mt. Ktaadn (Blake).
28. *P. caperata* (L.) Ach. Trunks and stones. Wells (Blake); Orono (Harvey).
29. *P. conspersa* (Ehrh.) Ach. Rocks and stones. Cumberland (Blake); Orono (Harvey).
30. *P. centrifuga* (L.) Ach. Mt. Ktaadn (Blake); Mt. Desert (Tuckerm. N. A, Lichens, I. 65).
31. *P. incurva* (Pers.) Fr. Mt. Desert (Tuckerm. N. A. Lichens, I. 65).
32. *Physcia speciosa* (Wulf. Ach.) Nyl. On rocks. Wells (Blake).
33. *P. stellaris* (L.) On apple trees and poplar. Wells (Blake).

FAM. 3.—UMBILICARIEI.

34. *Umbilicaria proboscidea* (L.) Stenh. Alpine rocks. Mt. Ktaadn (Blake).
35. *U. polyphylla* (L.) Hoffm. Mt. Desert (Tuckerm. N. A. Lich. I. 85).
36. *U. flocculosa* Hoffm. Mt. Desert (Tuckerm. N. A. Lich. I. 85).
37. *U. hyperborea* Hoffm. Mt. Ktaadn (Blake).

38. *U. erosa* (Web.) Hoffm. Mt. Ktaadn (Blake).
39. *U. Muhlenbergii* (Ach.) Tuckerm. Cumberland (Blake).
40. *U. Dillenii* Tuckerm. Harrison (Blake); Searsport (Black).
41. *U. pustulata* (L.) Hoffm. Rocks. Cumberland (Blake).

FAM. 4.—PELTIGERI.

42. *Sticta amplissema* (Scop.) Mass. Trees. Cumberland (Blake); Orono (Harvey).
43. *S. herbacea* (Huds.) Ach. Cumberland (Blake); Orono (Harvey).
44. *S. pulmonaria* (L.) Ach. Common on trees. Cumberland (Blake); Orono (Harvey).
45. *S. crocata* (L.) Ach. Cumberland (Blake).
46. *Nephroma tomentosum* (Hoffm.) Kœrb. Harrison (Blake).
47. *N. Helveticum* Ach. N. Bridgton (Blake).
48. *N. laevigatum* Ach. Harrison (Blake).
49. *Petigera apthosa* (L.) Hoffm. Harrison (Blake); Orono (Harvey).
50. *P. horizontalis* (L.) Hoffm. Ground on moss. Cumberland (Blake); Orono (Harvey).
51. *P. polydactyla* (Neck.) Hoffm. Harrison and Mt. Ktaadn (Blake); Orono (Harvey).
52. *P. scuta* (Dicks.) Leight. N. Bridgton (Blake).

FAM. 5.—PANNARIEI.

53. *Pannaria granitina* (Sommerf.) Maine (Willey). (Tuck. N. A. Lich. I. 118.)
54. *P. plumbea* (Lightf.) Delis. Mt. Desert (Tuckerman N. A. Lich. I. 124).

FAM. 6.—COLLEMEI.

55. *Collema nigrescens* (Huds.) Ach. Harrison (Blake).
56. *Leptogium tremelloides* (L. f.) Fr. Harrison (Blake).
57. *L. chloromelum* (Sw.) Nyl. Maine (Blake).
58. *L. Burgessii* (Lightf.) Mont. Maine (Oakes). (Tuck. N. A. Lich. I. 165).
59. *L. myochroum saturninum* Schær. Harrison (Blake).

FAM. 7.—LECANOREI.

60. *Placodium eleganz* (Link) DC. On rocks. Wells (Blake).
61. *P. microphyllinum* Tuckerm. On old fences. Orono (Harvey).
62. *P. cerinum* (Hedw.) Næg. & Hepp. On rails, common. Me. (Blake); Orono (Harvey).
63. *P. ferrugineum discolor* Willey. Mt. Desert (Tuckerman). (Tuckerm. N. A. Lich. I. 177.)
64. *P. vitellinum* (Ehrh.) Næg. & Hepp. Dead wood. Cumberland (Blake).
65. *Lecanora pallida* (Schreb.) Schær. On beach trees. Wells (Blake); Orono (Harvey).
66. *L. subfusca distans* Ach. On trees and dead wood. Wells (Blake); Orono (Harvey).
67. *L. varia* (Ehrh.) Nyl. Harrison (Blake).
68. *L. tartarea* (L.) Ach. On rocks. Harrison (Blake).
69. *L. molybdina microcyclos* Wahl. (Tuckerm. N. A. Lich. I. 201.)

70. *Pertusaria velata* (Turn.) Nyl. Cumberland (Blake).
71. *P. multipunctata* (Turn.) Nyl. On yellow birch, with other Maine specimens, but not labeled (Blake).
72. *P. communis* D.C. In Blake's Herb. as *P. pertusa* Ach. No locality; but with Maine specimens (Blake).
73. *P. Wulfenii* D.C. Cumberland (Blake).
74. *Conotrema urceolatum* (Ach.) Tuckerm. In Blake's Herb. with Maine specimens, without locality. Orono (Harvey).

Tribe II.—Lecideacei.

FAM. 1.—CLADONIEI.

75. *Stereocaulon coralloides* Fr. Mt. Ktaadn (Blake).
76. *S. paschale* (L.) Fr. Mt. Ktaadn. Cumberland (Blake); Orono (Harvey).
77. *S. tomentosum* (Fr.) Th. Fr. On ground. Cumberland (Blake); Orono (Harvey).
78. *S. pileatum* Ach. Maine (Willey). (Tuckerm. N. A. Lich. 1. 233.)
79. *Cladonia pyxidata* (L.) Fr. On ground. Cumberland (Blake); Orono (Harvey).
80. *C. gracilis* (L.) Nyl. Type. Cumberland (Blake).
81. *C. gracilis verticillata* Fr. Mt. Ktaadn (Blake).
82. *C. gracilis cervicornis* Flœrk. North Bridgton (Blake).
83. *C. gracilis hybrida* Schær. Orono (Harvey).
84. *C. gracilis elongata* Fr. Maine (Willey). (Tuck. N. A. Lich. 1. 243); Orono (Harvey).
85. *C. turgida* (Ehrh.) Hoffm. On ground. Cumberland and Wells (Blake).
86. *C. squamosa* Hoffm. Mt. Ktaadn (Blake).
87. *C. squamosa furcata* Fr. Mt. Ktaadn (Blake).
88. *C. furcata crispata* Fl. Cumberland (Blake).
89. *C. furcata subulata* Fl. Mt. Ktaadn (Blake).
90. *C. rangiferina* (L.) Hoffm. Cumberland (Blake); Orono (Harvey).
91. *C. rangiferina sylvatica* L. Wells (Blake); Orono (Harvey).
92. *C. rangiferina alpestris* L. Mt. Ktaadn (Blake); Orono (Harvey).
93. *C. amaurocrea* (Fl.) Schær. Mt. Ktaadn (Blake); Holden (C. F. Dole).
94. *C. uncialis* (L.) Fr. Cumberland (Blake).
95. *C. uncialis adunca* Wells (Blake).
96. *C. Boryi* Tuckerm. Wells (Blake).
97. *C. cornucopioides* (L.) Fr. Mt. Ktaadn. Cumberland (Blake); Orono (Harvey).
98. *C. bellidiflora* (Ach.) Schær. Wells (Blake).
99. *C. macilenta* (Ehrh.) Hoffm. Specimens named *C. Flœrkiana* Fr. from Cumberland are in the Blake Herbarium, but probably should be referred to the above.
100. *C. cristatalla* Tuckerm. Wells (Blake); Orono (Harvey).

FAM. 3.—LECIDEEI.

101. *Bæomyces roseus* Pers. Common. Orono.
102. *Biatora ostreata* (Hoffm.) Fr. Mt. Desert (Willey). (Tuck. N. A. Lich. 2. 14.)

103. *B. coarctata* (Sm. Nyl.) Maine (Willey). (Tuck. N. A. Lich. 2. 15.)

104. *B. vernalis* (L.) Fr. Harrison (Blake).

105. *B. sanguino-atra* (Fr.) Tuckerm. Harrison (Blake). A specimen from Mt. Ktaadn named *Lecidea sanguinaria* Ach. seems to be referable to the above.

106. *B. carnulenta* Tuckerm. Maine (Willey). (Tuck. N. A. Lich. 2. 23.)

107. *Lecidea contigua* Fr. Mt. Ktaadn (Blake).

108. *Buellia parasema* (Ach.) Th. Fr. Orono (Harvey).

109. *B. Œderi* (Ach.) Br. & Rostr. Coast of Maine (Tuckerm.). (Tuck. N. A. Lich. 2. 102.)

110. *B. geographica* (L.) Tuck. Coast of Maine (Tuckerm.). (Tuck. N. A. Lich. 2. 103.)

Tribe III.—Graphidacei.

FAM. 1.—XYLOGRAPHEI.

111. *Xylographa parallela* Nyl. Maine (Pringle). (Tuck. N. A. Lich. 2. 112.)

112. *X. disseminata* Willey. Mt. Desert (Willey). (Tuck. N. A. Lich. 2. 112.)

113. *X. opgraphella* Nyl. Maine (Tuckerm.). (Tuck. N. A. Lich. 2. 113.)

FAM. 3.—OPEGRAPHEI.

114. *Graphis scripta* (L.) Ach. Cumberland (Blake); Orono (Harvey).

Tribe IV.—Caliciacei.

FAM. 1.—SPHÆROPHOREI.

115. *Sphærophorus fragilis* (L.) Pers. Mt. Ktaadn (Blake).

Lichens new to North America.

BY JOHN W. ECKFELDT.

During the past few years I have had under examination numerous collections of Lichens from all portions of North America, and among them quite a notable number have proven to be new. Many of these have been submitted to the kind observation of Drs. Nylander and Muller, and I have to thank them for the determinations. Not wishing to burden them with too much material from our country, I herewith submit the following paper on some noteworthy species.

PANNARIA APPLANATA n. sp.

Thallus squamulose, more or less irregularly lobulate, the divisions at the border cut-crenate, flat, quite closely adnate to the substrata; the centre sparsely granulose, pale olivaceous or a rusty yellow. Hypothallus showing in distinct patches and of a paler color. Apothecia scattered, rounded and elevated with a receding margin, simple and slightly paler than the disk. Spores small, ellipsoid or ovoid, hyaline, entire, $\frac{8\times 9}{2\frac{1}{2}\times 3}$ mic.

Occurring on various barks in San Luis Potosi, Mexico, 1887. Mr. C. G. Pringle, No. 155.

Thelotrema carnea n. sp.

Thallus orbicular, becoming irregularly diffused over large areas, thin-membranaceous, minutely granulose, soft, frequently traversed by narrow waving anastomosing black lines, from pale carnate to rosy pink. Apothecia small to very minute, sunken in the thalline layer, open, the interior exciple quite distinct from the outer border, which is erect with a rounded subcrenulate margin. Disk black, slightly roughened, the exterior exciple thickened. Spores oblong, triseptate $\frac{12\times 14}{3\times 3\frac{1}{2}}$ mic.

This striking species occurs on trunks of *Celtis occidentalis* in the low country near St. Martinsville, Louisiana. A. B. Langlois.

Biatora (Patellaria) floculescens n. sp.

Thallus more or less mixed, made up principally of small lobulate or crustaceous scales, roughish and covered by an extremely fine flocculent pubescence, imparting to the surface a soft appearance, ashy brown to darker. Apothecia quite flat, but becoming convex. Disk chestnut brown, margin simple, entire, receding in older stages of growth, paler within. Spores simple, ovoid, hyaline, entire $\frac{9\times 10}{5\times 6}$ mic.

On bark near Monterey, Mexico. Mr. C. G. Pringle, 1887, no. 253.

Biatora (Patellaria) dispersa n. sp.

Thallus smooth, uneven, finely granulate, limited by a fine line and dispersed evenly over the bark area, ash color and becoming paler at the border. Apothecia adnate, sessile, very flat; disk smooth and surrounded by a waving, irregular, paler, true margin which is enclosed by a thicker, light thalline ring, reddish brown to black, entire. Spores hyaline, broadly ovoid $\frac{9\times 12}{6\times 7}$ mic.

On barks, San Luis Potosi, Mexico. Mr. C. G. Pringle, 1887.

Biatora suturalis n. sp.

Thallus slightly thickened, crustaceous and becoming finely granulose, broken up into areola-like divisions, but not squamose, interspersed throughout by distinct, prominent, waving suture-like, black, diffuse lines, from pale ashy to cream color.

Apothecia flattish, scattered at first, a little concave, but afterwards somewhat convex, margin soon disappearing, disk brown. Spores acicular, hyaline $\frac{30\times40}{3\times4}$ mic.

On barks, San Luis Potosi, Mexico. Mr. C. G. Pringle, 1888, no. 183.

ARTHONIA DISTINCTA n. sp.

Thallus thin, smooth, white, indeterminate, slightly mealy. Apothecia very minute, round-lobed, and disposed to become radiate in small clusters, slightly sunken or in part even with the thallus; disk black, with a rough or uneven surface. Spores dark, 3–4-locular, broadly ovoid $\frac{15\times18}{7\times8}$ mic.

On smooth barks, San Luis Potosi, Mexico. Mr. C. G. Pringle, 1888. The similarity of this plant to *A. radiata* is marked, but certain characters determine it to be distinct.

TRYPETHELIUM PRINGLEI n. sp.

Thallus thin, smooth or generally finely tuberculate, tubercles rounded, elevated, diffused, from pale yellow to white; stromas prominent, round to oblong and irregularly protruding, paler than the surrounding crust. Osteoles minute, rounded, very prominent, dark brown. Spores broadly ellipsoid, quadriseptate $\frac{15\times20}{4\times6}$ mic.

A well marked species contrasting strikingly with *T. oligocarpum* Mull. Lich. Australia. Occurs on the trunks of trees near San Luis Potosi, Mexico. Mr. C. G. Pringle, no. 226.

TRYPETHELIUM SCITULENS n. sp.

Thallus slightly transversly wrinkled and smoothish, of an opaque, olive green color. Stromas prominent, rounded, becoming at length oblong, solitary or generally confluent, and more or less of the same color as the thallus. Osteoles numerous, very minute and closely approximate, mostly brown. Spores oblong ellipsoid, 10-septate $\frac{27\times33}{10\times12}$ mic.

On the trunks of various trees near San Luis Potosi, Mexico. Mr. C. G. Pringle, no. 200.

PYRENULA PAPULIFORMIS n. sp.

Thallus extremely thin, evanescent, diffuse, pale ash color, and often differing but slightly from the normal shade of the bark. Apothecia somewhat conoidal, black with a round spreading perithecium; osteole poreiform, innate. Epithecium pale, whitish. Hymenium black. Spores ellipsoid, elongated, hyaline, bilocular $\frac{14\times16}{4\times6}$ mic.

On trunks with smooth barks, San Luis Potosi, Mexico. Mr. C. G. Pringle. Not unlike *P. majuscula* Nyl. of the Hawaiian Islands in general appearance.

Notes on the Chromatophores of Astrophyllum sylvaticum Lindb. (Mnium cuspidatum Hedw.), and of some other Plants.

By Alfred C. Stokes.

Among the commonest mosses in my locality is the one usually referred to as *Mnium cuspidatum* Hedw., my specimens having been identified for me by Dr. G. N. Best, of Rosemont, N. J. The plant is always so attractive in appearance at almost any season, that for several years I have been in the habit of collecting it in the autumn, and of keeping it all winter under an inverted glass on my table, where in the diffused light of a warm room it will grow and flourish, and, as I have learned, supply the microscopist with several important objects for investigation, asking in return only that it shall be abundantly furnished with the moisture which it must have or die. I know that it has long been a favorite object of study with microscopical botanists, but I have not been able to learn that the observations which I have had the pleasure of making over it have been anticipated.

But the leaf-cells of *Astrophyllum sylvaticum* are so transparent, especially in the adult and the young conditions, that microscopical examination may be made of them in their living state. In these young and in the mature, but not old cells, the chromatophores (chloroplasts or chlorophyll-bodies) are so few and so conveniently scattered over the upper and the lower cell-surfaces that they may be studied with some ease and the protoplasmic cell-contents examined with as great comfort while the whole leaf is living in a 4 per cent. solution of sugar, in which its structure is apparently unaltered, and where for a time its functions are not vitiated. It is especially to the structure of the chloroplasts in these and in some other leaves that this paper is devoted.

There has been considerable discussion as well as considerable divergence of opinion in regard to the structure of the chlorophyll-grains. What I have to relate refers solely to what I have seen, or think that I have seen, in the chromatophores of the plants to be mentioned.

Any countryman is entitled to an opinion on all subjects, provided that the tools which he uses in his investigations are as good as can be had, that he uses them intelligently and that he describes his observations as he thinks he has seen the objects, holding his imagination in check, and always bearing in mind that he is human and therefore "prone to err." The tools in this special case are the ¼ and the ⅛ inch objectives, both by Zeiss, and both apochromatic; Spencer's homogeneous-immersion 1/10, N. A. 1.35; Reichert's semi-apochromatic, oil-immersion 1/12, N. A. 1.40; Gundlach's homogeneous-immersion 1/20, N. A. 1.22; an achromatic condenser; Powell and Lealand's 2-inch, and Zeiss' 8 and 27 eye-pieces, all compensating. The conditions are that the leaf shall be studied in the 4 per cent. sugar-solution with no preparation, except in some cases, the free-hand sectioning of the object and its immediate examination.

In reference to the structure of chloroplasts, F. Schwartz says* that they are formed of fibrillæ, which are arranged in a network, yet lie side by side attached to one another by what he calls metaxin. Such structure is not visible in the chromatophores of *Astrophyllum sylvaticum* nor in those of any other plant which I have examined; and likewise A. Meyer says† that he has failed to see the fibrillæ and does not hesitate to add that Schwartz's observations are incorrect. Schimper, in an extended treatise on the subject says‡ that the simplest chromatophores consist of a colorless protoplasmic substance without any visible internal structure or contents, and that this is sometimes the case during the whole of their existence, as with most leucoplasts.

Structure is so plainly visible on the external surfaces of the chloroplast of *Astrophyllum sylvaticum* that I confess to considerable regret when I failed in my efforts to section the chlorophyll-grains, or rather to assure myself that they had been sectioned after the effort to cut them had been made. Yet optical sections obtained with the best objectives of wide angle have always so plainly showed the structure from one surface to the other that I must believe that what appears so conspicuously on the outside is likewise continued throughout the entire chromatophore. I have not yet seen a chloroplast from this special moss, nor from any other plant in which they are externally structured, in which I have failed to observe the markings until the chromatophore became disintegrated; in sections where the chlorophyll-grains were presumably cut, homogeneous, internal substance has been equally invisible.

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* Cohn's Beitr. z. Biol. Pflanzen, 5: 1–224.

† Bot. Ztg. 46: 636.

‡ Pringsheim's Jahrb. f. wiss. Bot. 16: 1–247. Cf. Journ. Roy. Micros. Soc. (II.) 6: 640.

That the pitted or spongy aspect so apparent on the surface of the chloroplasts of *Astrophyllum* is continued within the internal substance is demonstrable only by means of the optical sections referred to, since the chlorophyll-grains are so loosely attached to the cell-wall, never coming into actual contact with it, but being imbedded in the threads of protoplasm which radiate through the cell, that they are forced out of the section by the pressure of the knife, and are either not positively cut or are lost. That the entire chromatophore is a chlorophyll-bearing, spongy body cannot, I think, be doubted, after a careful study with good objectives.

The surface-structure referred to, covers the entire chloroplast with an irregularly disposed series of depressions of unequal size and shape. These depressions are surrounded or produced by narrow elevations of the chromatophore-substance, the green coloring matter being as conspicuous in each of the delicate, ridge-like elevations as it is in the general body-substance of the chloroplast itself. When the chlorophyll-grain is examined in optical section, at irregular intervals around the entire margin of the body there come into view the edges of the ridge-like elevations which form the boundaries of the pits, and these appear as exceedingly delicate, green bars projecting from the body. The general appearance, when the chlorophyll-body is examined in this way, is remotely like that of the endocarp of certain stone-fruits, the surface of a peach-pit, for instance, the depressions on the surface of the peach-stone of course being even less regularly disposed and more shallow than are those of the chloroplast. If an optical section of the peach endocarp could be obtained, the ridges which surround the depressions would, to a certain extent, produce the delicate, bar-like projections as on the margins of the chloroplasts.

My attempts to make drawings of these surface-appearances have failed, although I have had the assistance of beautiful photo-micrographs prepared for me by Dr. H. G. Piffard, of New York, a most accomplished photo-micrographer. The structure is so delicate and so minute that even the photo-micrographs reproduced by the half-tone process would not satisfactorily show it. To see it with the microscope certain conditions are required.

These conditions must be complied with, or the depressions, as I believe them to be, will appear as whitish elevations comparable to the "pearls" on the diatoms when these plants are resolved in the common, that is, the incorrect way. These chromatophore-pearls, like the diatom-pearls in certain cases, become black depressions when the objective is properly focussed. If the apparent elevations on certain parts of certain diatoms are not elevations, then the apparent pearls as seen with a certain focus on the chromatophores are not elevations. In both cases they must be depressions or apertures; otherwise the entire fabric of the secondary structure of the diatoms falls to the ground. If the surface of the chromatophores of *Astrophyllum sylvaticum* is not deeply pitted, and if the entire structure, as seen in optical sections, is not similar to the trabecular formation of the ordinary sponge-skeleton, then those of us that have taken pleasure in the study of the secondary structure of the diatoms have had all our work for nothing, and have been pursuing a phantom. But the existence of this secondary diatom-structure can be demonstated beyond a peradventure.

The lowering of the objective to obtain this "black-dot" resolution gradually brings into view the blackness of the depressions, with the well-defined outlines of the narrow elevations which surround them. The surface of the chromatophore then has a spongy appearance, the black spaces between the irregular network seeming to enter the substance of the chloroplast and there to produce, not a structureless, homogeneous body, but a body of green meshes. Those that have studied the secondary structure of certain diatoms are familiar with the fact that when the whitish pearls have become black dots by the proper focussing, the edges of the black apertures are not always sharply cut; in fact there is no actual, well-defined edge to the opening, but it is approached by a concave slope, a smooth depression which surrounds the black aperture and leads to it. A homely comparison may be made by thrusting the finger-end into stiff dough, when the resulting depression will show an evenly rounded approach similar to that so readily observable in certain diatoms. A similar condition exists with the depressions on the chromatophores of this moss.

This spongy aspect is not an optical illusion produced by minute granules or other objects within the protoplasm of the cell. The pits and the laterally projecting bars are as conspicuous when the chromatophore has been forcibly extruded and is floating freely in the mounting medium as they are while within the living cell. But the pits are exceedingly shallow; and the narrow ridges are correspondingly low, for I have not been able to measure them with the ordinary micrometer, as the lines made by the diamond are so broad in comparison that they obliterate the bar-like points of the optical section.

That the chromatophores of all plants are trabecular in structure is not yet to be written. In many of our common plants it cannot be demonstrated. In those of *Astrophyllum sylvaticum* there can be no doubt of the trabeculæ.

There has also been some discussion and some disparity of opinion as to the existence of a membrane surrounding the chlorophyll-grain. That all chromatophores are surrounded by a membrane is another assertion which must be put to the test by examining the chlorophyll-grains of all species of plants. Yet Tschirch says* that after experiments on the living cells of *Elodea* (*Anacharis*) and of *Nitella* he is convinced that all chlorophyll-bodies and aleurone-grains are surrounded by an envelope. Repeating this statement in another place† he adds that the coloring matter of two different grains never comes into contact. This is a part of the morphology of the chlorophyll-grains of *Astrophyllum sylvaticum*, and of those in some other plants. Yet in the moss the membrane is so exceedingly delicate that it is scarcely possible actually to see it in either the young or in the old chloroplasts. But in those which are undergoing the act of bipartition, this surrounding membrane may at times be examined with some ease, although those fortunate times are not common. In such chromatophores I have seen the membrane, but it becomes especially apparent in those which have been treated with alcohol to bleach the chlorophyll, followed by staining with eosin; fig. 2 representing an optical section of a chlorophyll-grain after such treatment. The two grains are completely divided with the exception of the enveloping membrane which still binds them together. The alcohol has contracted the chromatophore, thus leaving the delicate membrane visible not only about and between the dividing planes, but around the margins of one of the chloroplasts, where it is, as usual, prevented from coming into contact with the body of the grain by the projecting ridges of the surface-structure. On the smaller chromatophore at the left-hand side the membrane is not visible, but in the space separating the two grains it passes as a distinct but exceedingly delicate line, the space being bounded above, as shown in the figure, by a membrane conspicuously depressed in the middle, the lower boundary being as plainly developed.

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* Ber. Deutsch. Bot. Gesell. 1: (1883).

† Ib. 2: 265.

In fig. 4 is shown a greatly enlarged drawing of the inner ends of the same chloroplasts with the central membrane. The distance from one chlorophyll-grain to the other was about $\frac{1}{18000}$ inch. I have no means of measuring the thickness of the central membrane which separates the chloroplasts, but that membrane is double. This is an exceedingly "fine point" microscopically, and it is here that the "black-dot" resolution again makes itself useful. If the two membranes had been undivided or in actual contact throughout their whole length, the double structure would of course have been invisible. That they were not thus in actual contact the "black-dot" resolution demonstrates by exhibiting the minute black spaces near the upper and the lower extremities, as the chromatophores lie horizontally across the field, the attempt to show this on the greatly enlarged scale in fig. 4 being hardly more than a diagram. In fig. 2 the black, irregular line around the edge of one chromatophore represents the space between the body of the chlorophyll-grain and the exceedingly delicate membrane, the white projections being the optical sections of the elevated ridges which give the surface its pitted aspect.

In fig. 3 is shown an isolated chromatophore in optical section after treatment with alcohol, by which the grain has shrunk, while a few of the ridges have become rather more prominent, the outline here representing the surrounding membrane, the space between, in the microscopical specimen, being black.

If such a microscopically broad space of darkness is an optical illusion, I am at a loss to account for it on any optical principle with which I am familar. If it is an optical illusion, why the upper margin of the black band should slope from the long projection near the upper right-hand border of the chloroplast to the minutely projecting point at the very apex of that corner, and form concavities between succeeding elevations, becomes even more inexplicable. The enveloping membrane exists.

In addition to the membrane there is a coating of the cell-protoplasm in which each chlorophyll-grain is imbedded. Yet each chloroplast is not entirely isolated from all the others, but is intimately connected by the peculiar arrangement of the protoplasm, which does not entirely fill the cell as it frequently does in similar bodies, but forms a kind of protoplasmic cobweb which loosely fills each cell with its delicate threads. It is these protoplasmic threads which connect together the chromatophores, and it appears to be by their contractions that the position of the green bodies is changed under the influence of the light. A somewhat similar arrangement of the protoplasm has been observed in *Selaginella* by Haberlandt;* a part of one of his drawings is shown in fig. 1.

In *Astrophyllum* these protoplasmic threads are colorless, variously branched and in continuous movement. Every chromatophore in the cell is connected by their means with every other, and the threads themselves radiate from the nucleus.

In fig. 5 are shown several leaf-cells with the protoplasmic threads extending across and around, some being in the central parts of the cell and therefore having no chromatophores in their course. These delicate filaments are continually quivering, lengthening and shortening, extending themselves in long curves or loops, or contracting into short lines or into little rings. When the leaf-cells are active, the protoplasmic meshes are so numerous and so conspicuous that the entire cell seems to be crowded with the network, within the threads of which float the chromatophores like minute green sponges in a colorless, ever quivering jelly.

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* Flora, 71: 221.

Fig. 7 shows the nucleus and its connection with the protoplasmic filaments. Fig. 8 is a transverse vertical section of a leaf to show the chromatophores arranged, as they usually are, near the upper and the lower cell-walls, with the loose network of protoplasmic threads and in the central cell, the nucleus temporarily adhering to the cell-wall. The leaf varies in thickness from $\frac{1}{1250}$ inch at the margin to $\frac{1}{700}$ near the midrib.

Even in the oldest cells the chromatophores are seldom in contact even by their enveloping membranes, and if in a healthy condition there is always a thin layer of protoplasm enclosing and separating each from all the others, and separating each from its apparent contact with the upper and lower cell-walls. When two chromatophores are in apparent contact, careful scrutiny with a high magnifying power will exhibit the black spaces between the peripheral trabeculæ, or the bright, continuous line which is present between two chloroplasts in which the act of bipartition is nearly completed.

Ageratum conyzoides L. cultivated variety *Mexicanum.* In the mesophyll-cells of this plant the chromatophores have a structure similar to that of the chlorophyll-grains of *Astrophyllum sylvaticum*, the larger having more conspicuous trabeculæ, and the surrounding membrane, which exists here also is raised to a shorter distance above the body of the chromatophore on account of the lower elevation of the surface-ridges, or of the network of elevated lines between which the depressions or apertures, as I believe them to be, are placed.

Fig. 6 is a diagram of two chloroplasts from this plant in an advanced stage of bipartition, with the central apertures somewhat exaggerated, as also are the surface depressions represented by the black dots. Attention is asked to the demonstation of the surrounding membrane where it extends from one chromatophore to the other, and is apparently continuous with the external edge of the dark space which defines and separates the optical sections of the projecting ridges.

Mesembryanthemum crystallinum. (Cultivated.) The chromatophores here seem to have a spongy structure similar to that of the chlorophyll-grains of the two plants previously mentioned, but they are so sensitive to adverse influences that, although the trabecular appearance is conspicuous and distinct, it may possibly be produced by another cause. The 4 per cent. solution of sugar sometimes distorts the chloroplasts, and disintegrates them speedily; water often acts even more quickly, and when they are forced out of the cell and examined in the cell-sap, the changes are almost as rapid and disastrous to their integrity of form and of structure. Yet, although necessarily examined in such unpropitious surroundings, they seem to possess the pitted surface and the delicate enveloping membrane.

Heliotropium Peruvianum L. (Cultivated.) The chromatophores are here prominently trabecular, or spongy in structure. An enveloping membrane can be demonstrated at the periphery of an optical section.

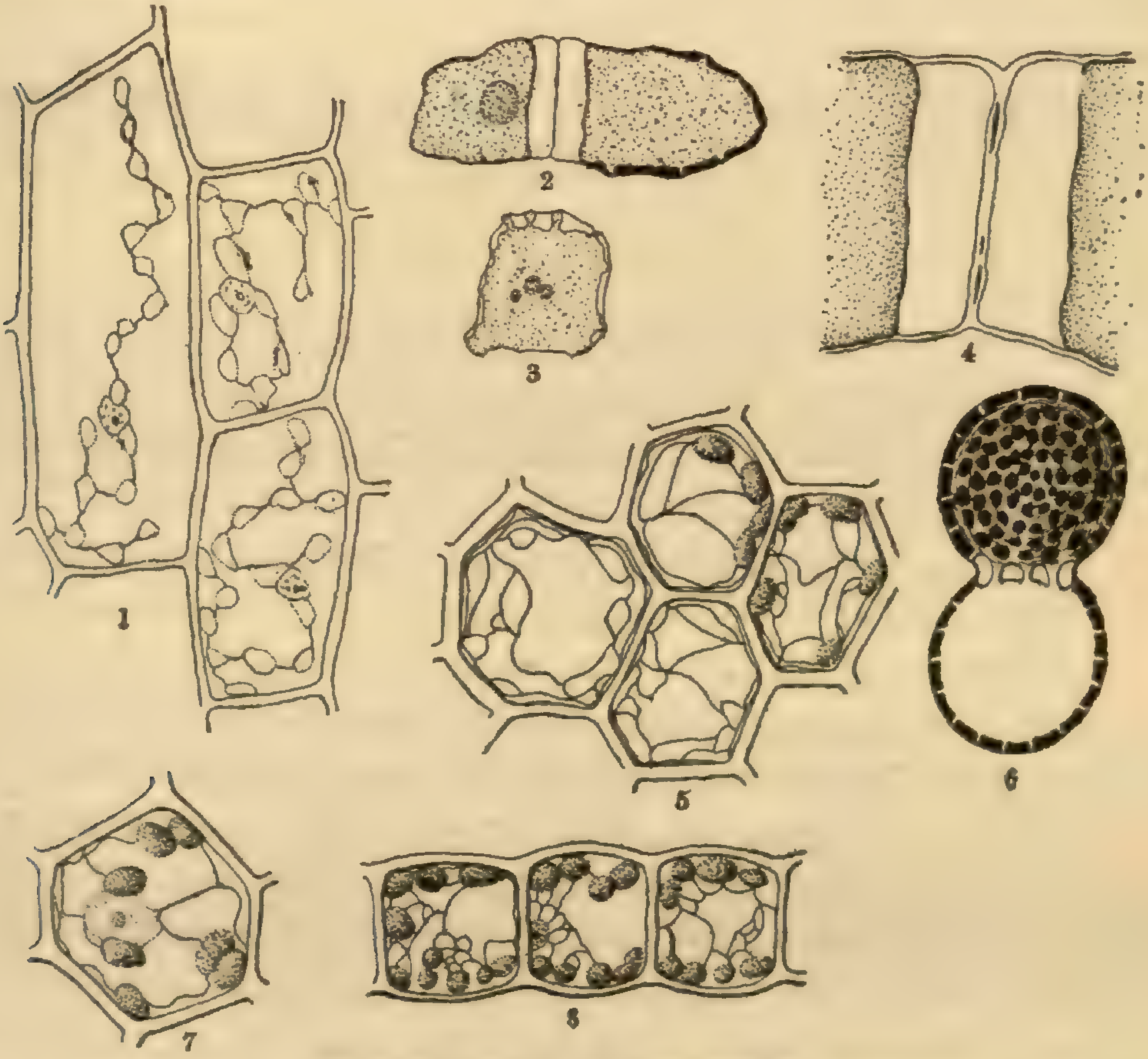
Begonia sempervirens. (Cultivated.) Here the chlorophyll-grains are large and the reticulated structure is prominently developed. At this writing I have not seen the chloroplasts of any plant so conspicuously pitted, and, as I am convinced, so plainly cancellated in structure throughout the entire chromatophore. It is not a difficult task practically to cut successive optical sections from the upper surface of the chloropast to the lower, and in these circumstances, with these special objects, the cancellous structure extends through the whole body and is not mere surface pitting. These chlorophyll-grains offer one of the most convincing demonstrations of this interesting point that I have thus far observed.

Here, as elsewhere, the green coloring-matter is not contained in the meshes of the structure, the meshes being the spaces formed and bounded by the threads or bands which together form the chromatophore, but is within those filaments themselves. The meshes, by the correct focus of the objective, are jet black.

A membrane also seems to surround the chlorophyll-grains of this variety of *Begonia*, but is not commonly visible, being demonstrable only with certain of the larger chromatophores.

In the young leaves of other varieties of the genus a similar structure is readily visible, but in the mature and in the old the appearance becomes obsolete. The change seems to begin early in the life of the chlorophyll-grain and to advance rapidly, the chromatophore soon becoming filled with starch. That the action of the light which augments the formation of the starch has any concomitant influence on the trabecular structure of the chromatophore itself I do not know.

This structure of the chlorophyll-grain is probably not uncommon.



Explanation of Figures.

FIG. 1. *Selaginella Krusiana;* chromatophores connected together by short, delicate threads of protoplasm. (After Haberlandt.)

FIG. 2. Chromatophore of *Astrophyllum sylvaticum* in optical section, showing the surrounding membrane between two dividing grains, with optic sections of the elevated ridges and of the black space between the body of the chromatophore and the membrane.

FIG. 3. Optical section of a chromatophore of *Astrophyllum* after treatment with alcohol and with eosin staining; showing the projecting elevations or ridges and the external membrane, the space between the body and the membrane being left white.

FIG. 4. Greatly enlarged view of the central portion of Fig. 2, showing dark spaces within the membrane between the dividing chromatophores; this part of the membrane is becoming double.

FIG. 5. Protoplasmic threads in the leaf-cells of *Astrophyllum sylvaticum*.

FIG. 6. Dividing chromatophores of *Ageratum conyzoides*, showing the pitted surface, the laterally projecting ridges (in optical section) and the central spaces between the dividing chromatophores. Diagram.

FIG. 7. Leaf-cell of *Astrophyllum*, showing nucleus, chromatophores and protoplasmic threads.

FIG. 8. Transverse vertical section of leaf-cells of *Astrophyllum*, showing chromatophores, nucleus and protoplasmic threads.

Proceedings of the Botanical Club, A. A. A. S., Brooklyn Meeting, August 15-22, 1894.

The meetings were held in the Packer Institute.

FRIDAY MORNING, AUGUST 17TH.

The meeting was called to order by Professor N. L. Britton, and in the absence of the President, Prof. D. H. Campbell, Prof. Geo. F. Atkinson was elected to the office of President.

Prof. F. C. Newcombe was elected to the Secretary's office in the absence of Mr. W. T. Swingle.

The report of the Secretary was read, showing for the year ending Aug. 14, 1894, receipts to the amount of $8, and an equal amount of disbursements. The report was accepted. Voluntary contributions to the amount of $7.32 were made by those present.

Prof. C. E. Bessey then gave some notes on the germination of macrospores of *Marsilia vestita*. These were germinated in water, forming larger prothallia with rhizoids than are usually present in this genus.

Dr. Erwin F. Smith recommended the preliminary treatment of vegetable sections with tannin solution, in order by subsequent staining to differentiate micro-organisms present in the tissues.

Prof. F. C. Newcombe also spoke favorably of tannin solution as aiding in the differentiation of protoplasmic structure by subsequent staining.

Dr. W. J. Beal showed how measurements of parts may be helpful in the identification of grasses.

Prof. L. R. Jones reported that the raising of oats in Vermont imported from localities affected with smut tended to decrease the percentage of the disease.

Prof. N. L. Britton thought that the return of the oat to its native environment—that being probably similar to the conditions in Vermont—might cause a reversion to its original healthy growth.

Prof. B. T. Galloway was inclined to ascribe the decrease of smut in Vermont to conditions unfavorable to the germination of the sporidia.

Prof. B. T. Galloway, Dr. E. F. Smith and Mr. G. H. Hicks reported on the use of formaline as a preserving fluid, stating that in a 1 per cent. solution it is cheaper than alcohol, and for a period of several months, while it has been in use, it has preserved the colors of persistent leaves, fleshy fungi, and fruits much better than alcohol.

Prof. J. M. Coulter then called for the report of the Committee charged with the preparation of a check-list of Northeastern American plants.

Prof. N. L. Britton, Chairman of the Committee, reported that about two-thirds of the list was already printed and that the remainder would be printed as soon as possible. The delay in completing the project was due to the great amount of time required in verifying references. The Editor of the Torrey Botanical Club had offered to print the list as one of its MEMOIRS, and the offer had been accepted by the Committee as the most practicable means that had presented itself. The regular price of the MEMOIRS is $3.00 per volume, but this volume would be given to subscribers to a list now before the Club for $1.00. After the subscribers had been supplied the price would be raised to $3.00. The subscription list would be kept open until the work is issued. The report was accepted and the committee continued to complete the check-list.

Prof. C. E. Bessey suggested a board or cloth binding. Dr. Britton stated that the volume would consist of about 400 printed pages and bound in cloth would cost about $1.25 to subscribers. After considerable discussion it was finally understood that subscribers were to have a choice of bound and unbound copies, the unbound to cost $1.00 and the bound $1.25.

FRIDAY AFTERNOON, AUGUST 17TH.

Dr. E. F. Smith in the Chair.

Dr. Smith then presented "Additional Notes on the bacterial Disease of Cucumbers, with an Exhibit of Photomicrographs." The cause of the disease lies in the filling of the vessels by the growth in them of bacteria, thus stopping the flow of water.

Prof. C. E. Bessey spoke on "Extreme Decapitalization," in nomenclature, suggesting that the Club might do good by sending to publishers who violate usage a statement of accepted practice. Prof. B. T. Galloway moved that a committee of three be appointed to take the matter under consideration. The motion was carried, and the Chair announced that he would name the committee later.

Prof. L. R. Jones recommended a form of *Hæmatococcus* for class demonstration of motile gametes.

The same speaker exhibited a method of showing leaves between glass plates to classes of students.

MONDAY MORNING, AUGUST 20TH.

The meeting was called to order by the President, who announced Mr. Elias J. Durand to speak on "Sporangial Trichomes in certain Ferns."

Trichomes occur more or less abundantly on the sporangia of certain ferns, especially those of the genera *Phegopteris* and *Polypodium*. The occurrence is constant and not accidental. In the instances already observed these hairs, which are either acute or capitate, are always found on the lateral wall of the sporangium near the annulus. So far as noted trichomes occur on the sporangia of such ferns only as have similar ones on the surface of the frond. The occurrence of trichomes on sporangia is consistent with the known epidermal nature of the latter. The function of sporangial hairs may be protective, as they occur most abundantly on non-indusiate ferns.

Mr. Arthur Hollick spoke on "Stipules and their Significance from the Standpoint of Palæobotany."

The material upon which these remarks is based was collected from the Laramie horizon near Walsenberg, Colo., for the late Prof. J. S. Newberry, but was not described by him. The geological side of the subject was discussed in a paper read before Section E, but some points of biologic interest it was thought best to present before the Botanical Club in an informal way.

The specimens in question represent a new fossil species of *Liriodendron*, which is unique inasmuch as the petioles of the leaves are bordered by wing-like appendages, a quarter of an inch or more in width. Similar appendages are known in other genera, and it is a matter of importance to know just what they represent.

Platanus occidentalis shows basilar expansions of its leaves extending down the petioles, besides conspicuous foliaceous stipules at the base of the petioles. The significance of these has been shown by Prof. Lester F. Ward in his "Palæontologic History of the Genus *Platanus*,"* in which he advocates the theory that the stipular appendages represent portions of the lower part of the leaf-blades which have become separated and crowded down the petiole.

With this new species of *Liriodendron* we are apparently now in a position to treat this genus in the same manner and to consider the conspicuous stipules which are on the young branches, but soon disappear, as possibly the ultimate development of the wing-like appendages along the petioles of our Laramie fossil, which in turn may be merely separated portions of the bases of the leaf blades. This interpretation involves the whole question of the importance and significance of stipules in general and what they really represent in the living flora. The remarks were illustrated by drawings of fossil species of *Liriodendron* and *Platanus* and mounted specimens of *L. Tulipifera* and *P. occidentalis.*

Prof. C. R. Barnes communicated the fact that the sporophyte stage of *Bryoziphium* (*Eustichium*) *Norvegicum*, found ten years or more ago in Wisconsin by Mrs. E. G. Britton, and which had not been reported since, were collected in great quantities the present summer by Mr. Cheney. It seems certain that this moss does not often fruit.

Mr. J. J. Davis reported *Entyloma Flœrkeœ* as forming its chains of gonidia in a broken instead of in a straight line.

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* Proc. U. S. Nat. Mus. 11: 39–42.

TUESDAY MORNING, AUGUST 21ST.

Prof. B. D. Halsted exhibited photographs of variegated leaves made by the Solandi method, the description of the same having been published in a former number of the BULLETIN.

Prof. C. E. Bessey spoke for "A better Pronunciation of botanical Terms." After citing examples of inconsistent pronunciation, the speaker suggested Percey Miles' essay written for Nicholson's Gardener's Dictionary as a guide, *i. e.* the adoption of the Roman method of pronunciation, although it is consistency that is desirable rather than any particular method. Prof. N. L. Britton moved that a standing committee on pronunciation be appointed, the members to be named by the President. The motion was carried.

Prof. B. D. Halsted spoke briefly on "The Peach-spotting Fungus as a Leaf-parasite," stating that the fungus effects numerous perforations in the peach leaves.

Mr. E. J. Durand presented notes on "The Development of *Olpidium* sp., one of the Chytridiaceæ." This plant is parasitic on *Spirogyra*. The uniciliated zoospores work their way into the interior of the algal cell, where they grow in size and acquire a wall as the sporangium. The cell of the host is much swollen by the sporangium or several sporangia which occur within it. When the fungus approaches maturity a tube is given out from one side of the sporangium which extends to some distance outside the cell of the host, at the same time the protoplasm of the fungus becomes divided up into ciliated zoospores which finally escape through the tube by the rupture of its apex.

Prof. B. D. Halsted exhibited leaves of *Pæonia* discolored by some disease whose cause he had ascertained to be not from insects. He asked for suggestions from anyone as to its cause.

Dr. E. F. Smith explained a method for making pure cultures of fungi. The method consists in the usual distribution of spores in agar or gelatine to be poured subsequently into a Petrie dish. When the gelatine has become solid, the dish is inverted on the stage of a microscope, a single spore found and surrounded by a ring of ink on the bottom of the dish. The disk of gelatine is then cut out, put into another dish and fresh nutrient solution poured over it. In this way the development of a single spore may be easily followed.

The President made an announcement of the organization of the Botanical Society of America, stating that the charter members selected by the Club at the Madison meeting had organized in Brooklyn by electing Prof. Wm. Trelease, President; Prof. N. L. Britton, Vice-President; Mr. John Donnell Smith, Treasurer, and Prof. C. R. Barnes, Secretary.

The committee appointed to nominate officers of the Club for next year reported as follows:

For President—Douglas H. Campbell, of Leland Stanford, Jr., University.

For Secretary—Frederick C. Newcombe, of Michigan University.

Signed, B. T. GALLOWAY,
G. H. HICKS,
E. J. DURAND,
Committee.

The report of the committee was accepted and adopted.

Prof. C. E. Bessey and Mr. Roscoe Pound explained the work of the Botanical Seminar in making a survey of the flora of Nebraska, and exhibited advance sheets of Parts I. and II. of the Flora of Nebraska.

Mr. M. B. Waite spoke of the killing of young shoots of the pear by excessive transpiration. The same speaker also offered suggestions on the staining of the flagellæ of bacteria.

Profs. Galloway, Bessey and Coville were named as the committee to prepare a statement for the convenience of publishers, that errors in the use of capitals in nomenclature might be avoided.

The Club then adjourned to meet at the assembling of the A. A. A. S. next year.

FREDERICK C. NEWCOMBE,
Secretary.

Organization of the Botanical Society of America.

Pursuant to a call issued by the committee appointed from the original members of the new national association of botanists, a meeting for organization was held at Brooklyn, N. Y., on August

15th, 1894, and continued on several succeeding days, eleven members being present. The committee submitted a draft of a constitution, which, after some modification, was adopted, and the society organized by the election of the following officers: President, Wm. Trelease; Vice-President, N. L. Britton; Treasurer, John Donnell Smith; Secretary, Chas. R. Barnes. Among the provisions of the constitution the following are of general interest:

Only American botanists engaged in research, who have published works of recognized merit, shall be eligible to active membership. Candidates for active membership shall be recommended by three active members of the society, not members of the council, who shall certify that the candidate is eligible under the provisions of the constitution. The officers, together with the last past President, and two members elected by the society at its annual meeting, shall constitute a council, which shall be charged with such duties as are prescribed by the society and shall represent it in the intervals between meetings. The society shall hold an annual meeting at such time and place as the council may select, and special meetings for the presentation of papers or the transaction of business at such other times and places as the society or council may from time to time deem necessary.

Titles of Botanical Papers presented before the Section of Botany, A. A. A. S., Brooklyn Meeting, August 16-23, 1894.

In the absence of Prof. Lucien M. Underwood, Vice-president of the Section, Prof. C. E. Bessey, Vice-president for the preceding year was requested to retain the chair. Prof. Underwood's address, "The Evolution of the Hepaticæ," was read by Dr. S. Ely Jelliffe.

The papers read during the sessions were as follows:

"The Growth of Radishes as affected by the Size and Weight of the Seed," by B. T. Galloway.

"The Work of the Indiana Biological Survey," By A. W. Butler.

"The Movement of Gases in Rhizomes," by Katherine E. Golden.

"Some interesting Conditions in Wood resulting from the Attacks of Insects and Woodpeckers," by A. D. Hopkins.

"The Sugar Maples of Central Michigan," by W. J. Beal.

"Some Affinities among Cactaceæ," by John M. Coulter.

"Simplification and Degeneration," by Charles E. Bessey.

"Regulatory Growth of Mechanical Tissue," by Frederick C. Newcombe.

"Further Studies in the Relationship and Arrangement of the Flowering Plants," by Charles E. Bessey.

"Relation of Age of Type to Variability," by L. H. Bailey.

"Limits of Biological Experiments," by Manly Miles.

"The Struggle for Existence under Cultivation," by L. H. Bailey.

"Relation between the Functions of the vegetative and reproductive Leaves of *Onoclea*," by George F. Atkinson.

"*Lophotopappus*, a new Genus of Mutisiaceous Compositæ, and *Fluckigeria*, a new Genus of Gesneriaceæ," by H. H. Rusby.

"On the Swarm Spores of *Pythium* and *Ceratiomyxa*," by George F. Atkinson.

"A Revision of the Genus *Scouleria*," by Elizabeth G. Britton.

"Evidence as to the former Existence of large Trees on Nantucket Island," by Burt G. Wilder.

"Notes on the Primary Foliage and the Leaf-Scars in *Pinus rigida*, by N. L. Britton.

"Notes upon *Chalara paradoxa*," by Byron D. Halsted.

"A Hybrid among the Mosses," by Elizazeth G. Britton.

"Notes upon the Root Rot of Beets," by Byron D. Halsted.

"On *Torreya* as a generic Name," by N. L. Britton.

"Some notes on the Genus *Encalpyta*," by Elizabeth G. Britton.

"Species of *Taphrina* parasitic on *Populus*," by Mrs. F. W. Patterson.

Prof. J. C. Arthur was elected Vice-President of the Section for the next meeting, and Mr. B. T. Galloway, Secretary.

Report of the Committee on Bibliography of the Madison Botanical Congress.

To Section G, A. A. A. S.:

The committee on bibliography appointed by the Madison Botanical Congress was directed to report to Section G of the American Association for the Advancement of Science. This Section, therefore, is asked to receive the following report and take such action thereupon as seems wise:

The committee report that progress has been made during the past year in carrying out the suggestions made to the Madison Botanical Congress.* The first recommendation thereto made, viz.: "That there should be published a catalogue of papers [relating to American botany] by authors," has been undertaken and so far as it has gone has been successfully accomplished by the coöperation of a number of botanists with the editors of the BULLETIN of the Torrey Botanical Club and the Cambridge Botanical Supply Co. This index; printed first in the BULLETIN, is reprinted upon standard cards by the Cambridge Botanical Supply Co., so that any number of copies can be had and arranged by subjects or by journals as desired. Every effort will be made by those charged with the preparation of this index and its first publication to make it complete, and to have it conform exactly to the rules of citation prepared by this committee. The work of publication upon cards, however, is not adequately supported. The committee sincerely hope that this form of publication will not have to be given up, and they therefore urge that those interested testify their interest by sending their subscriptions to the Cambridge Botanical Supply Co., Cambridge, Mass.

The committee also announce that the BOTANICAL GAZETTE, in connection with the Cambridge Botanical Supply Co., is ready to undertake the publication of the supplementary list of journals referred to in section *1. b.* of the committee's report † to the Congress which appointed it. The publication of these lists of journals upon cards will be begun as soon as subscribers sufficient to defray the expense of printing the cards can be secured. In the same way the BULLETIN of the Torrey Botanical Club will undertake the publication of the list of authors referred to in the committee's report under *I. c.* If the number of subscribers to the index of papers above mentioned as in course of publication can be immediately increased, these author cards will, for the present year, be sent free to subscribers.

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* Proc. Madison Bot. Congress, 45. Je. 1894.

† Loc. cit.

The committee again call attention to the index of new genera and species of plants now being issued on cards by Miss Josephine E. Clark of Washington, D. C., and commend this to the support of botanists. Regarding this private publication they beg to suggest (1) that there be added to these cards such marks as will serve to identify the series when distributed in other indexes; (2) that in the interest of completeness *all* new names relating to North American plants be included.

A year's experience in the working of the rules for citations approved by the Madison Congress has not shown the necessity or desirability of any changes. To those rules, however, the committee desire to add the following amplifications:

In *f.* p. 46, l. c., before the last sentence insert: In case the original paging is unknown an em dash should occupy its place, the reprint paging being given in accordance with the foregoing rule.

The committee also recommend the adoption of the two following paragraphs as addenda:

j. If it is considered desirable to give other data than series number (if any), volume number, page and date, these should be added in brackets after the date. But useless or unnecessary data should be avoided.

k. Citations of reviews, abstracts and all such secondary references should be enclosed in parentheses.

Since uniformity is the chief object in the adoption of the rules for citation by the Congress, the committee call attention to the necessity of an exact following of these rules by as many writers and publishers as can be induced to give adhesion to them. To facilitate this we recommend that the editors of the BULLETIN of the Torrey Botanical Club, the BOTANICAL GAZETTE, ERYTHEA and the AMERICAN NATURALIST be requested to publish these rules and examples of as great a variety of citations as practicable. The committee also desire to issue these on tag-board sheets in a form which can be readily distributed and preserved for convenient reference. To enable the committee to do this, and to disseminate information upon these points, we recommend that the Council of the A. A. A. S. be requested to make a grant of $25 to cover the necessary expenses which may be incurred.

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Atkinson, G. F. Notes on some Exoasceæ of the United States. Bull. Torr. Bot. Club, **21**: 372–380. 20 Au. 1894.

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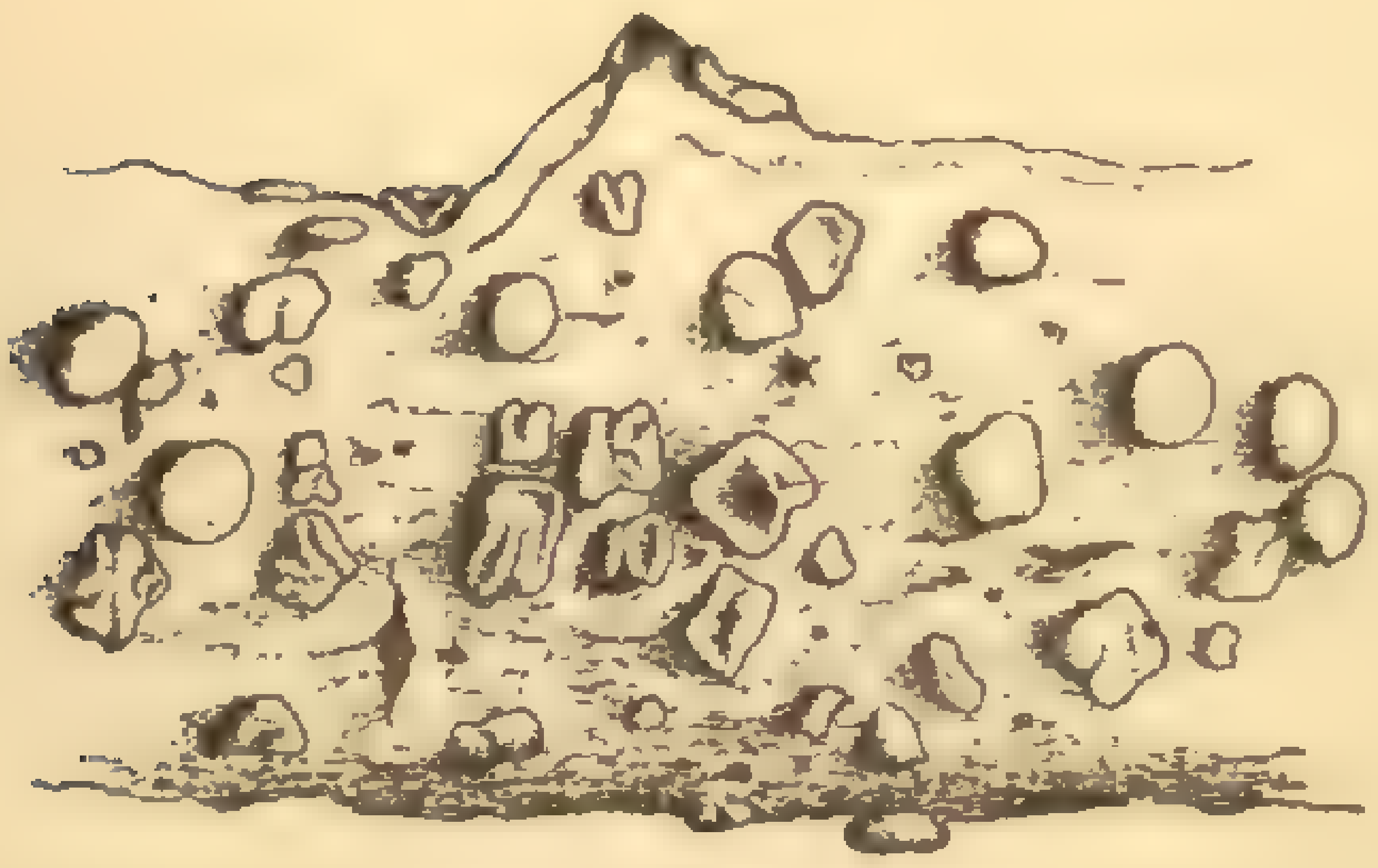

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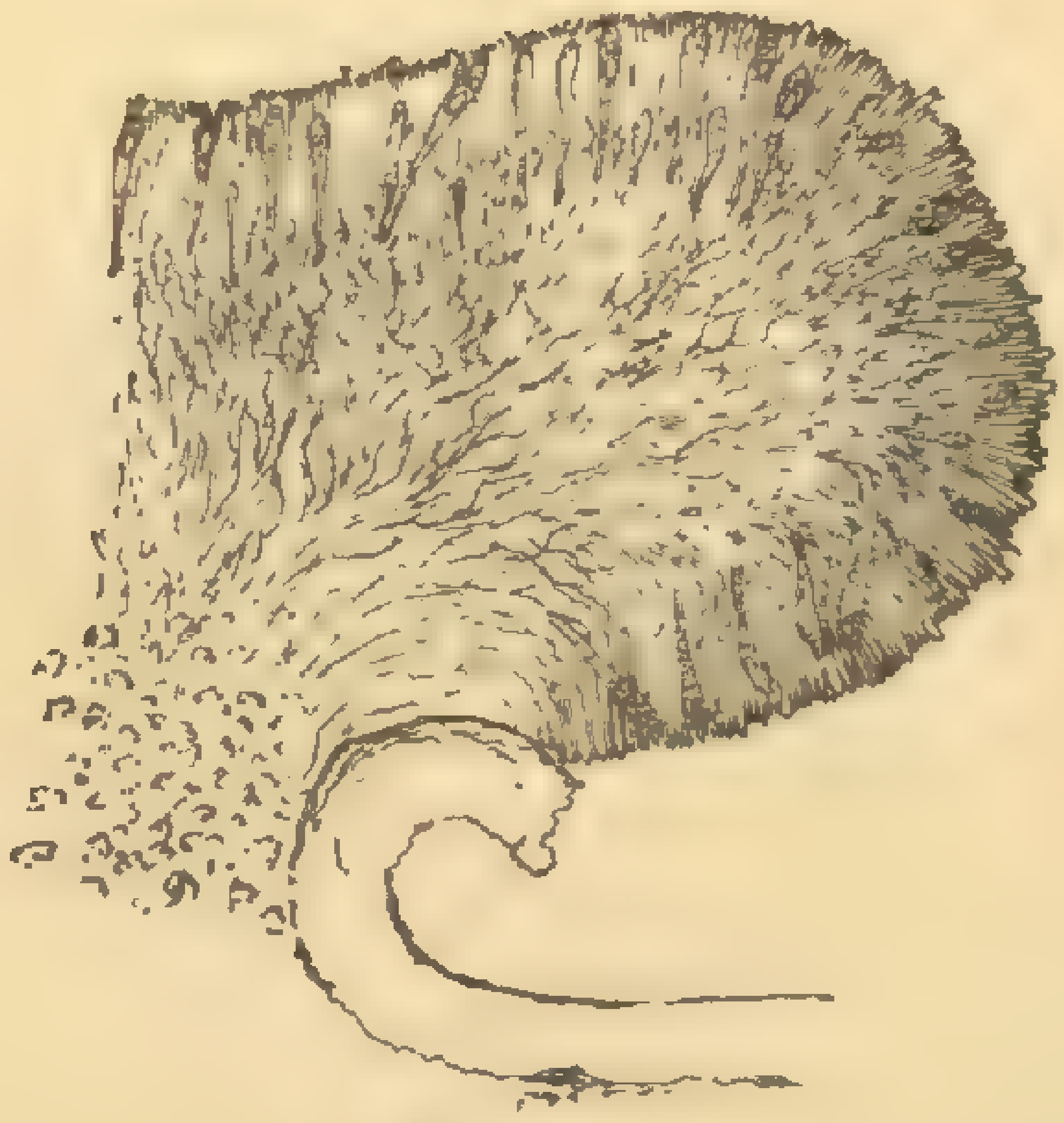

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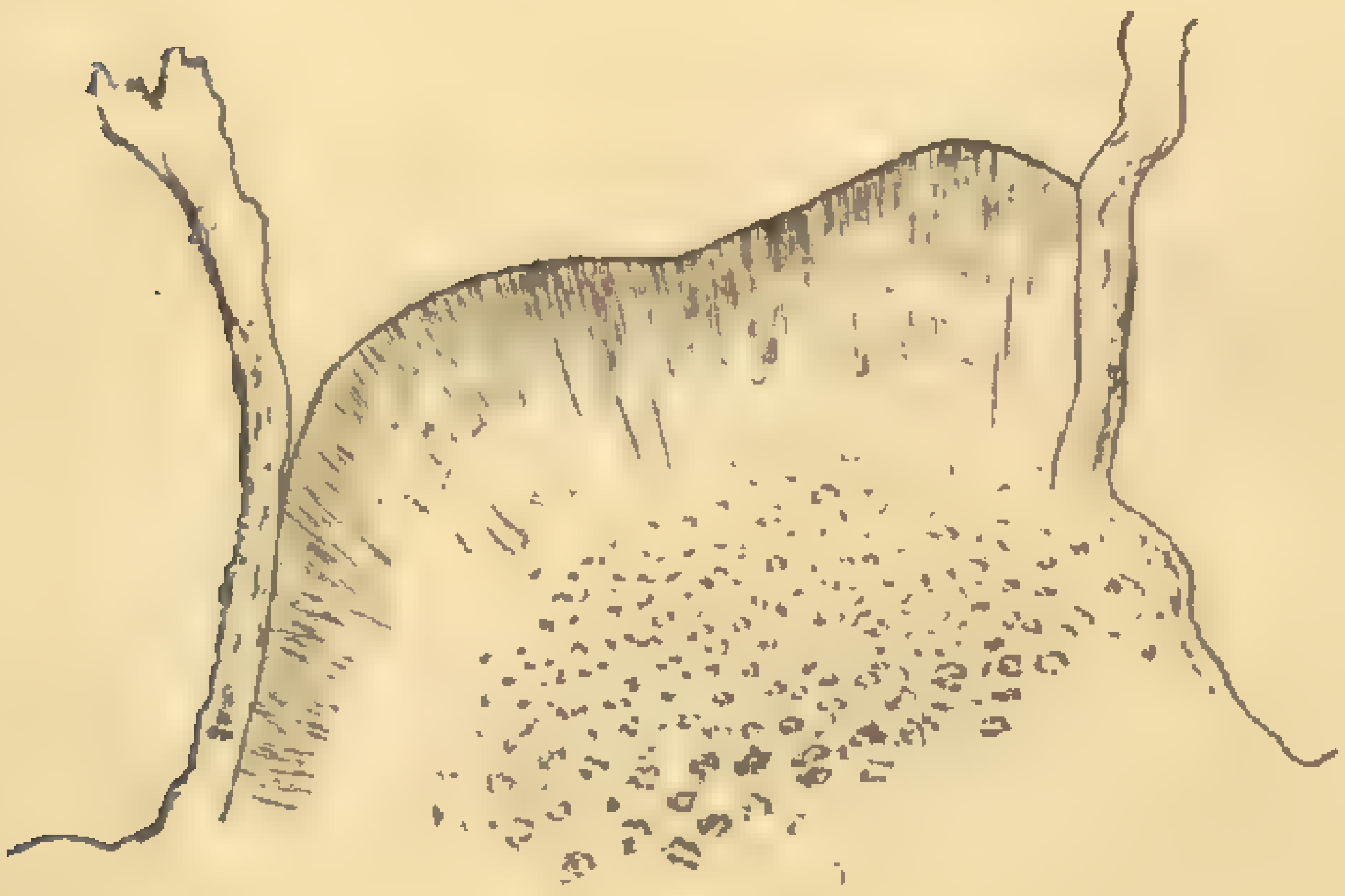

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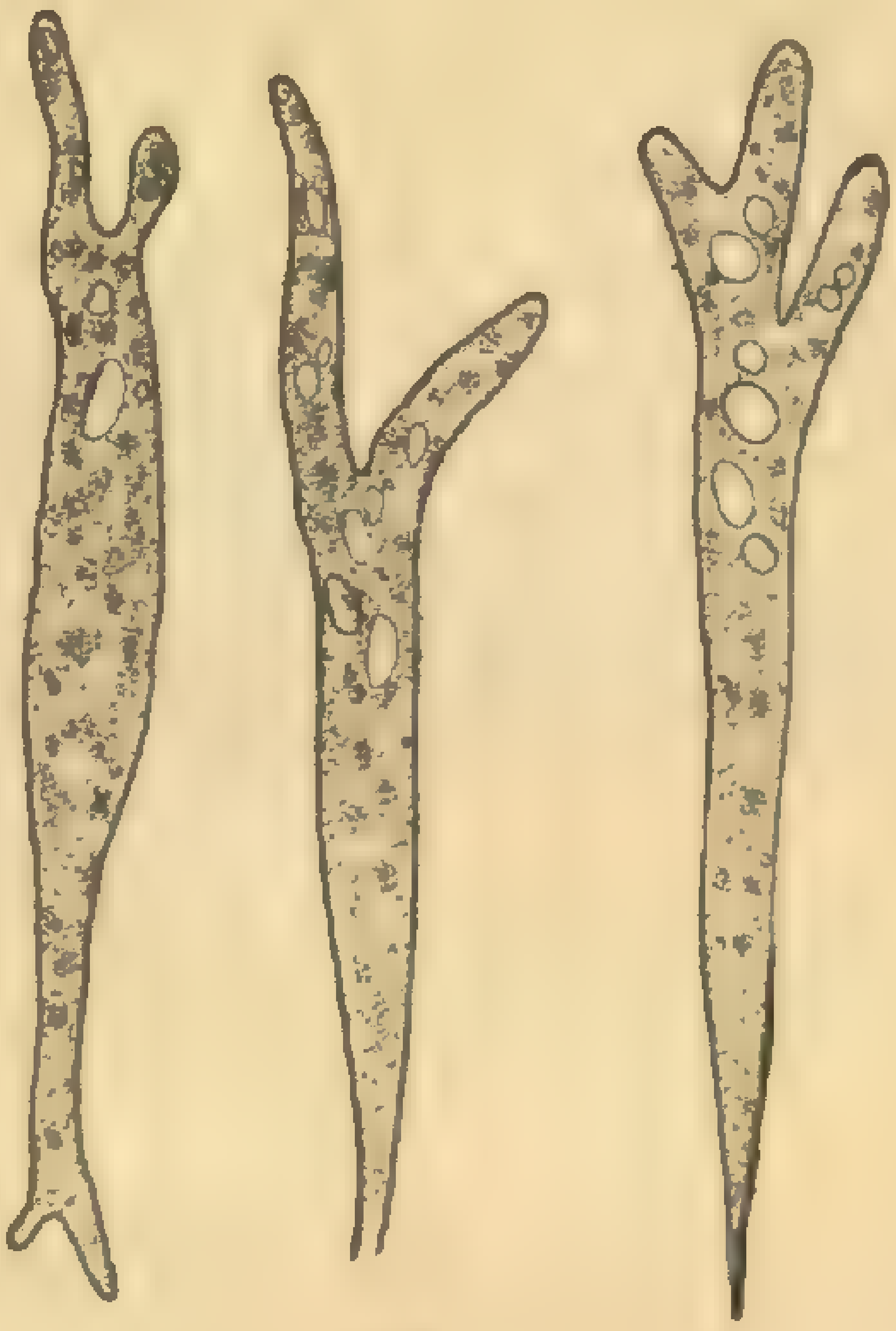

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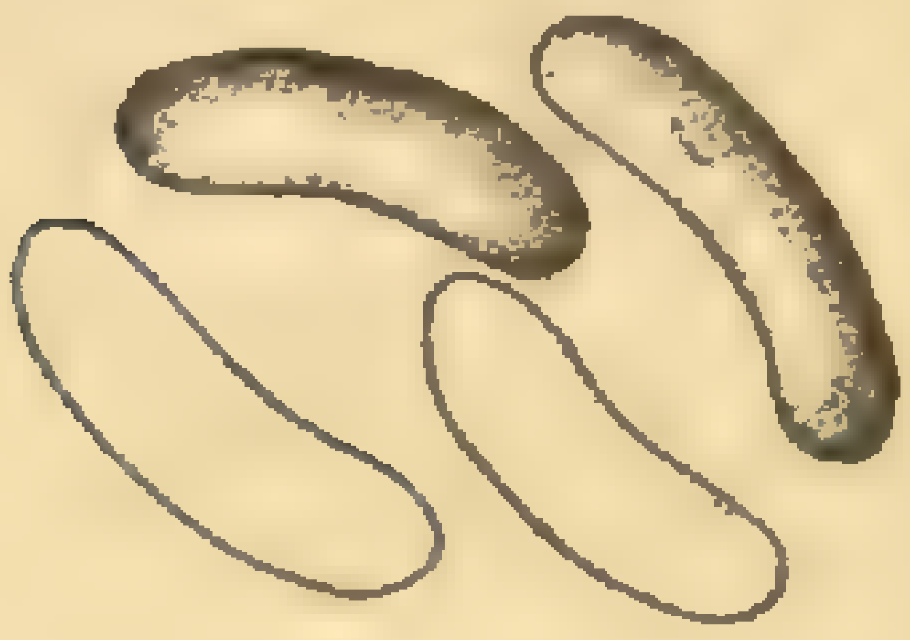

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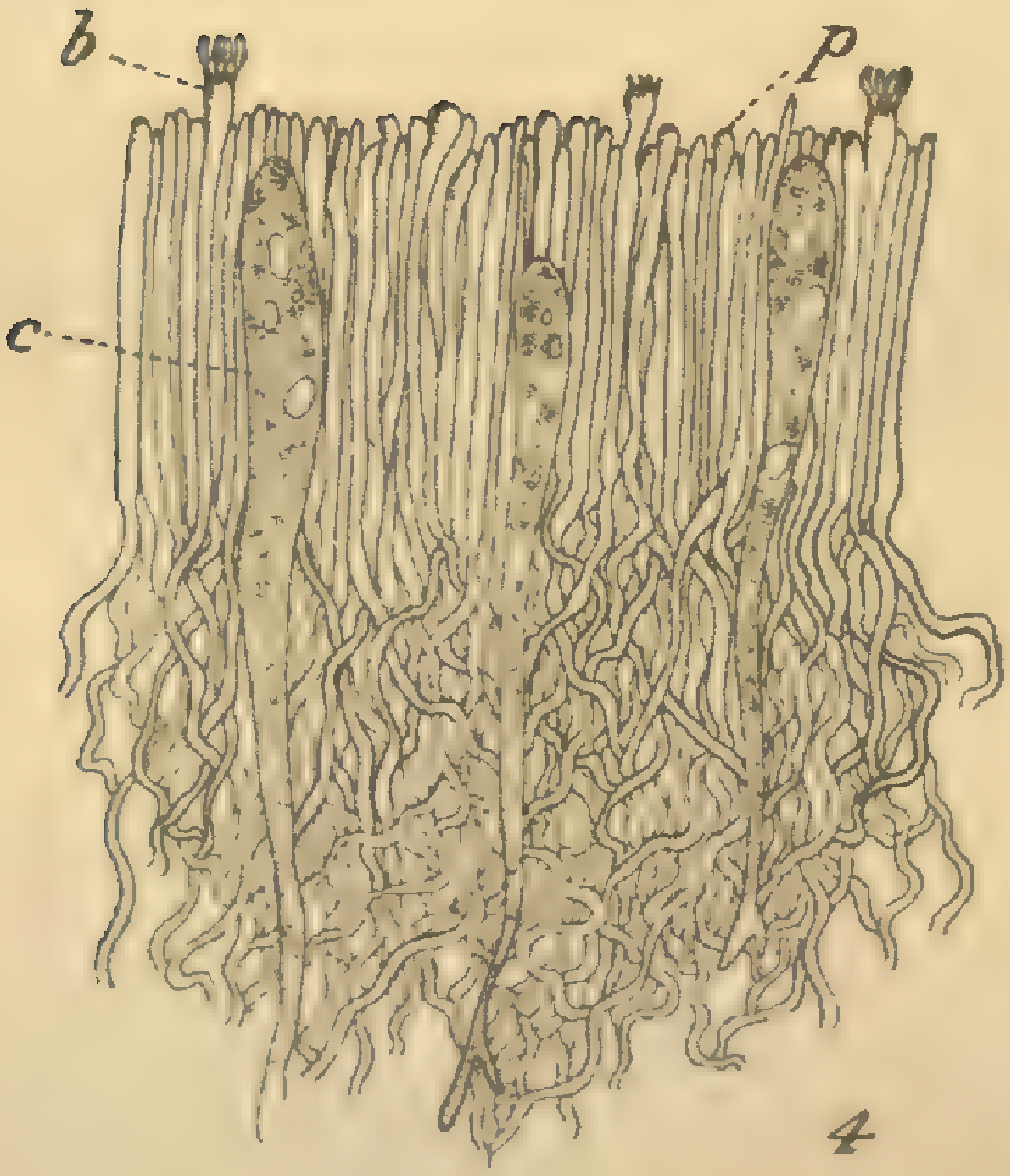

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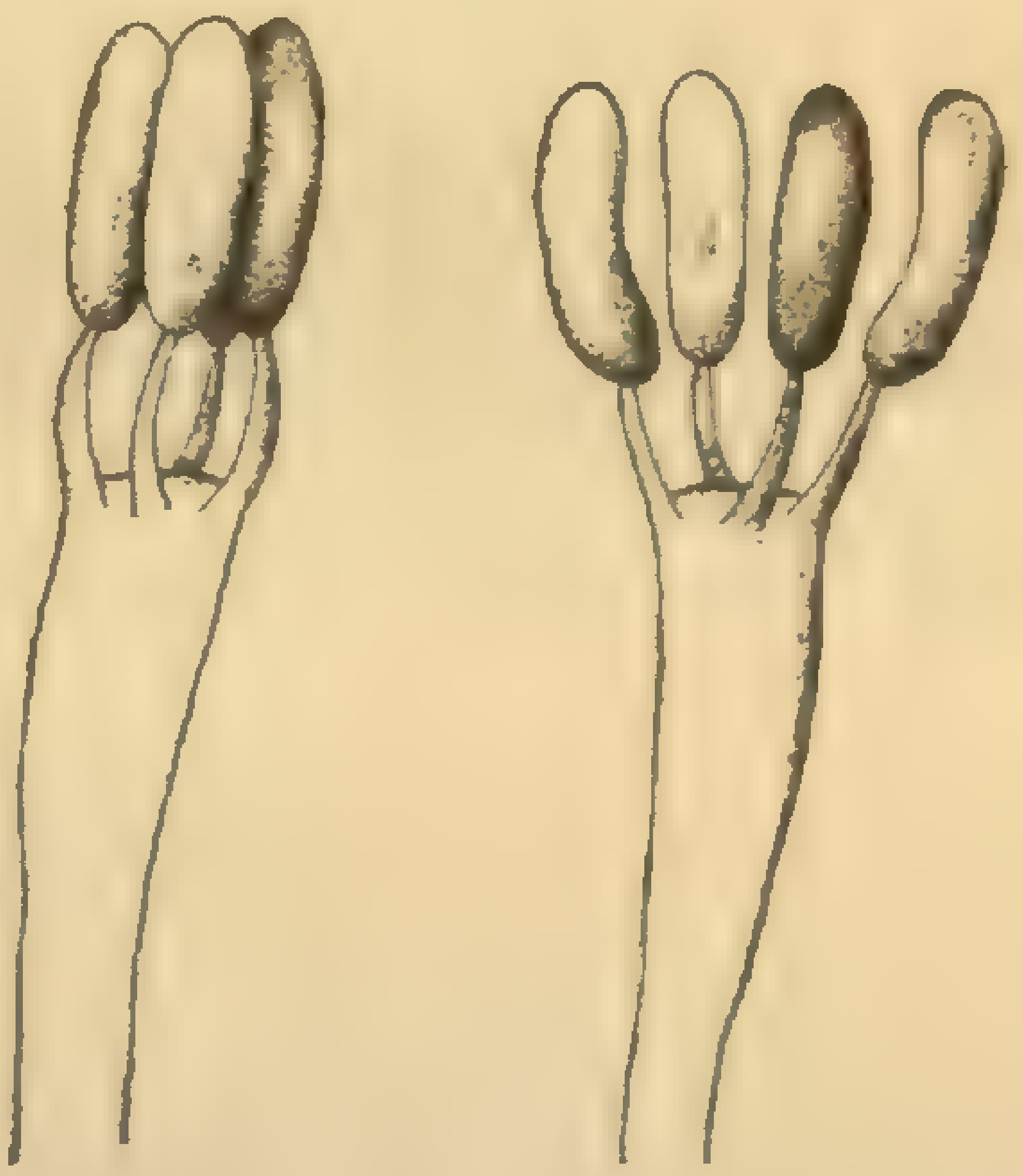

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VOL. 21. OCTOBER, 1894. No. 10.

BULLETIN

OF THE

TORREY BOTANICAL CLUB.

A MONTHLY JOURNAL OF BOTANY.

EDITED BY

NATHANIEL LORD BRITTON,

AND OTHER MEMBERS OF THE CLUB.

CONTENTS:

PAGE.
The Smilaceæ of North and Central America: *Thomas Morong* 419
A preliminary Revision of the Genus *Lathyrus* in North and Central America: *Theodore G. White* 444
A new fossil Hepatic from the Lower Yellowstone in Montana: *F. H. Knowlton* (PLATE 219) 458
BOTANICAL NOTES.—*Steironema intermedium* 460
INDEX TO RECENT LITERATURE RELATING TO AMERICAN BOTANY 461

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BULLETIN

OF THE

TORREY BOTANICAL CLUB.

Vol. 21. Lancaster, Pa., October 24, 1894. No. 10.

The Smilaceæ of North and Central America.

BY THOMAS MORONG.

The Smilaceæ have of late years been regarded as a tribe or suborder of Liliaceæ by many good botanists such as, for instance, Bentham and Hooker, and Engler and Prantl. The reasons for considering them a distinct natural family have been stated none too strongly by Mr. J. G. Baker.* Their orthotropous ovules, their peculiar stipular sheaths and tendrils, rigid and netted-veined leaves with petioles articulated near or at the blades, small umbellate and dioecious flowers, articulated pedicels which are set upon the receptacle in foveolæ, as Mr. Baker happily observes, like a ball in a socket, and flexuous, woody and often prickly stems, furnish a combination of characters which certainly separates them widely from any Liliaceous group. In addition to this, the baccate fruit of *Smilax* is entirely unique, unlike anything found elsewhere, so far as I am aware.

In the New World we have no representative of the small family Phileriaceæ, which is looked upon as a connecting link between Smilaceæ and Asparageæ; nor any species of *Heterosmilax* or *Rhipogonum*, the only other genera of the family. We are therefore restricted to the single genus *Smilax*, which is represented by 3 species in Canada, 16 in the United States, 32 in Mexico and Central America, and about 67 in South America. Enumerating only the distinct forms found in these several districts, we find about 110 species in the Western Hemisphere, or a little more than half the number ascribed by M. A. De Candolle, in his admirable monograph, to the entire world.

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* Journ. Linn. Soc. 14 : 510.

In this paper I take no notice of the species occurring in the West India Islands, about a dozen in number, except the few which have crept across the water to our coasts.

In my account of the Mexican and Central American species, in cases where I have been unable to study specimens, I have drawn freely upon the descriptions of Schlechtendal,* Kunth† and especially that great storehouse provided by M. De Candolle.‡ The last author has in his general preface so thoroughly canvassed the structure of the leaves, the inflorescence, flowers, fecundation, dissemination, and geographical distribution of the species, that little or nothing can be added upon these points. The rootstocks, tubers, and fruit of *Smilax* have scarcely been touched by any but American authors, and therefore more extended remarks upon these will be allowable.

SMILAX L. Sp. Pl. 1028 (1753).

The genus, at least so far as the species of this country are concerned, are most conveniently divided into two groups, those which are annual, with herbaceous and unarmed stems, and those, by far the greater number, which have woody, perennial stems, more or less armed with prickles. Most of the species climb upon other shrubs and trees by means of a pair of tendrils which grow at the summit of a stipular wing § on each side of the petiole, often not developing till the stem is several years of age. Blades 3–9-nerved, mostly coriaceous, at least when old, separating from the petiole above the tendrils, entire, denticulate or spiny upon the margins, and sometimes upon the nerves also. Flowers usually greenish yellow, small, dioecious, in peduncled umbels. Pedicels upon a globular or oval receptacle, in pits or foveolæ, from which they fall out at maturity, bearing the fruit with them.

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* Linnæa, 18: 446–455. 1844.

† Enum. 5: 160–270.

‡ Monog. Phan. 1: 1–212.

§ De Candolle regards this appendage as more in the nature of a modified leaf-segment or leaflet than a stipule, but it seems to me that a stipule is nothing else than a leaflet at the base of a petiole.

Segments of the perianth 6, in 2 series, the inner and outer nearly equal, commonly larger than the stamens. Stamens 6 or more; anthers introrse, basifixed, 2-celled, the cells separated by a very narrow septum, appearing 1-celled when open; filaments free, attached to the base of the perianth. Staminate flowers without the rudiment of an ovary. Pistillate flowers usually smaller than the staminate, with 3 or more abortive stamens, termed staminodia by some; ovary 3-celled, each cell 1–2-ovuled; style very short or none; stigmas rather thick, recurved. Fruit baccate, globular or ovoid, 1–6-seeded, red or bluish-black when ripe. In structure the berry is very peculiar. Taking that of *S. rotundifolia*, a common northern species, by way of illustration, we find externally a thin, shining coat, separable from the inner parts. Beneath this lies a thin reddish pulp, through which three strengthening bands or ribs run from the base to the apex, uniting with each other like hoops. That these ribs are not intended to separate the cells is shown in the fact that they run across the backs of the seeds along the middle, and not along the dividing lines of the cells. They serve to impart firmness to the softer parts of the berry and to support the exterior coat. Just below the pulp, but separate from it, lie from one to several hyaline elastic sacs, one enclosing each seed, appearing like so many cells. These sacs are rubber-like, and so elastic that they may be stretched many times their length without breaking. According to a Texas correspondent of Mr. E. E. Sterns* this curious property is so noticeable in *S. Bona-nox* that it has led to the popular name "Stretchberry," by which that species is there known. It has been much disputed whether these sacs are in the nature of a test or an aril.† That they are no part of the proper perianth, but adjuncts of the seeds, seems plain enough, but so far as I can see, they are neither aril nor test, but simply seed envelopes, although it may be hard to say what purpose they subserve in the economy of the plant. Beneath the sacs, between them and the seeds, is another pulpy mass, which is attached to the hilum, covering about one-half of the seed. This has to my eyes all the appearance of a true aril, as it looks like a growth formed subsequently to the fertilization. Seeds with a brownish shining sometimes rough test, enclosing a hard, horny, white albumen, at the tubercular end of which lies a minute, straight embryo, more or less remote from the hilum. When there is only a single seed it is spherical, when several they are hemispherical or present two faces running to an edge, with convex backs.

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* Bull. Torr. Club, **15**: **162**.

† Mr. Sterns in the article referred to has discussed the subject in a fresh and original way. He inclines to the opinion that the sacs here spoken of are to be considered as test and not as aril.

The rootstocks are, in many of the species, at least, tuberous, throwing out firm fibrous roots. These will be noticed in the specific descriptions.

The prophylla or bud scales are numerous upon the tubers, the rootstocks and the lower part of the stems, occurring also under each branch. They are semi-amplexicaul, thick, ovate, and seldom expand into true leaves until the plant is fully developed.

The prickles do not furnish characters to be depended upon. They may always be presumed to be present normally in the woody species, but owing to poverty of growth or other circumstances, they are often wanting, especially on the branches and branchlets. Frequently species that produce them abundantly in some plants will be entirely destitute of them in others. They may be stout and strong, or weak, straight or a little recurved, terete or flat, numerous or scanty, white or black-tipped, and that in the same species. The only specific character to be drawn from the prickles lies in the shape, being acicular or needle-shaped in some species and broad-based and stout in others. When a species of this group is said in the following descriptions to be unarmed, it must be understood that only the specimens examined are unarmed.

*** Stems annual, herbaceous, unarmed.**

1. SMILAX HERBACEA L. Sp. Pl. 1030 (1753).

S. pulverulenta Michx. Fl. Bor. Am. 2: 238 (1803).

S. peduncularis Willd. Sp. Pl. 4: 786 (1806).

S. lasioneuron Hook. Fl. Bor. Am. 2: 173 (between 1834 and 1840).

Coprosmanthus herbaceus and *C. peduncularis* Kunth, Enum. 5: 265 (1850).

Rootstocks tuberous, the tubers resembling those of Solomon's Seal. Tubers short, thick, each of them throwing out in turn a short ligament upon which is a new tuber from which the next year's stem is evolved, the old plant dying down to the ground at the end of the season. Each stem leaves a circular scar, and many generations are successively attached to each other. One gathered recently by the writer exhibited 15 such scars, showing the rootstock to be at least that number of years old.

Stems glabrous, often glaucous, climbing by tendrils 3°–10°, obtusely angled or terete, commonly branching. Leaves distichous. Petioles varying in length from 4″ to 3½′. Blades ovate, broadly ovate, rounded or lanceolate, obtuse or cordate at base, acute, acuminate or cuspidate at the apex, frequently downy beneath (var. *pulverulenta*, A. Gray), smooth or denticulate on the margins, copiously lineolate, 7–9-nerved and sometimes with an additional obscure marginal nerve on each side, the orbicular forms 2′–3′ long, and 1½′–3¼′ wide; the ovate 2½′–5′ long and 1½′–3½′ wide; the lanceolate (var. *Simsii*. A. DC.) 1½′–3′ long and 10″–15″ wide. Peduncles 4′–9′ long, usually much longer than the petioles (6–10 times), 15–80-flowered, flattened, thickening in fruit; stipular sheaths commonly not over 2″–3″ in length, sometimes elongated with age to 10″. Pedicels 3″–8″ long. Flowers carrion-scented in anthesis. I can detect no odor in the leaves or flower buds. Segments of male perianth 2″–2½″ long, ¼–⅓ longer than the stamens. Stamens 6, occasionally 5 or 7; filaments 2 or 3 times as long as the anthers. Female flowers smaller; staminodia very apparent. Ovary ovoid, about 2″ long, 3-celled, 2 ovules in each cell; stigmas short, ovate, apparently sessile. Berries globose, bluish-black, 2–4-seeded, 3″–4″ in diameter, usually very abundant.

Woodlands, New Brunswick to Ontario and Dakota, south to Florida, Nebraska and Louisiana.

The form called *lasioneuron* by Hooker occurs in the Saskatchewan region. April–June.

2. SMILAX ECIRRHATA (Engelm.) S. Wats.; A. Gray, Man. Ed. 6, 520 (1890).

Coprosmanthus herbaceus var. *ecirrhatus* Engelm.; Kunth, Enum. : 266 (1850).

Coprosmanthus herbaceus Chapm. Fl. S. States, 477 (1860), not Kunth.

Smilax herbacea Ell. Bot. S. C. and Ga. **2**: 702 (1824), not L.

Smilax herbacea var. *ecirrhata* A. DC. Monog. Phan. **1**: 52 (1878).

This species is closely allied to No. 1 and resembles it except in the following particulars:

Stem simple, low, erect, without tendrils or with only a few in the uppermost axils, 6′–12′ high, or sometimes twice that height. Leaves often verticillately massed at the top of the stem. Stipular sheaths none, or rarely there is a mere thin-edged enlargement of the base of the petiole, erose-denticulate on the margins. Blade usually pubescent beneath, more or less pubescent-ciliate on the margins, mucronate at the apex. Peduncles springing from oblong scales below the leaves, or from the lowest axils. Anthers from one-half to nearly as long as the filaments.

Virginia to Florida, west to Ohio and Minnesota. May–June.

3. Smilax tamnifolia Michx. Fl. Bor. Am. 2: 238 (1803).

Coprosmanthus tamnifolius Kunth, Enum. 5: 267 (1850).

Glabrous. Stem terete or obtusely angular. Leaves and tendrils numerous. Petioles 6″–1½′ long; sheaths none or only 1″ long, not winged. Blades for the greater part ovate-hastate, with broad, obtuse lobes at the base, slightly constricted in the middle, varying to ovate-lanceolate, truncate or subcordate at base, acute or obtuse and cuspidate, sometimes acuminate at the apex, smooth on the margins, 5–7-nerved, 15″–3′ long and 6″–2′ broad at the base. The leaves are green on both sides, commonly copiously lineolate, the nerves prominent in both sides, and the 3 midnerves often close together and nearly parallel. Peduncles nearly filiform, 1–3 from the same axils, terete or angled, often flattening in drying, usually much longer than the petioles, 1′–4′ long, 10–30-flowered. Perianth-segments of male flowers ovate, obtuse, ¾″–1¼″ long, slightly pubescent on the tips, a little longer that the stamens, obscurely 3-nerved. Stamens 6; anthers as long as the filaments or not more than one-half as long. Pedicels 2″–3″ in length. Pistillate flowers not seen. Berries black, globose, 2″–3″ in diameter, 1–3-seeded.

Dry pine barrens, New Jersey and Pennsylvania to South Carolina and Tennessee. May–July.

*** Stems perennial, woody, more or less prickly.**

† Berries black or bluish-black.

‡ Fruit ripening the first year.

4. Smilax glauca Walt. Fl. Car. 245 (1787).

Smilax spinulosa J. E. Smith, Rees' Cyc. 33: (1819).

Rootstock running deep into the ground, conspicuously knotted and tuberous. Tubers large, ovoid, often 1′–1½′ long and 1′

thick, composed of 2 or 3 nodes, frequently massed together conglomerately, and throwing out numerous, strong fibrous roots.*

Stem terete, the branches and branchlets angled, often somewhat quadrangular, armed with rather stout, scattered or numerous prickles which are straight or a little recurved, sometimes flat; more commonly the branches are naked. Petioles 3″–6″ long Blades glaucous beneath and sometimes also above as well as are the branches, commonly ovate, sometimes oblong-lanceolate or slightly panduriform, rounded or occasionally cordate or subcordate at base, abruptly acute or cuspidate at the apex, smooth on the margins, lineolate or often opaque, 1½′–6′ long, ½′–5′ wide, mostly 5-nerved, occasionally with an additional obscure marginal nerve on each side. Peduncles flattened, 6″–16″ long, 6–12-flowered. Pedicels 2″–4″ long. Segments of the male perianth ¼ to ⅓ longer then the stamens. Anthers longer than the filaments. Berries bluish-black, shining, about 3″ in diameter, 2–3-seeded.

Smilax spinulosa J. E. Smith (Torr. Fl. N. Y. **2**: 303), is a form of this species quite common on Staten and Long Islands, and in other parts of New York. It is distinguished by the numerous small prickles on the lower part of the stem, and leaves often elongated or slightly panduriform. The leaves of *S. glauca* are often clothed below with a minute scurfy pubescence, as well as a glaucous bloom. The berries also are frequently glaucous, especially in dried specimens not fully mature.

In general the species may be readily recognized by its ovate 5-nerved, strongly glaucous leaves, and its comparatively few flowers and fruit and short pedicels.

Dry or sandy grounds. Nantucket to Florida and Texas, west to Kansas. Occurs also in Mexico. May–June.

5. SMILAX ROTUNDIFOLIA L. Sp. Pl. 1030 (1753).

Smilax caduca L. Sp. Pl. 1030 (1753).

Smilax quadrangularis Muhl.; Willd. Sp. Pl. **4**: 775 (1806).

Rootstocks running for a long distance just under the surface of the ground, sparingly furnished with tubers like those of *S. glauca*, but seldom massed as in that species.† Glabrous. Stem

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* These tubers are described and figured by Mr. Theodore Holm in "Contributions to the knowledge of the germination of some North American plants," Memoirs Torr. Club, **2**: 84. *f. 124–126.*

† The tubers of this species are described and figured in the work of Mr. Holm, above cited.

terete, the branches and shoots frequently sharply 4-angled (var. *quadrangularis* A. Gray), climbing from 10 to 20 feet, often forming dense thickets. Prickles scattered, stout, straight or a little recurved, sometimes black at the apex, often wanting on the branches. Petiole 3″–6″ long, sheathed from ⅓ to ½ of its length, the sheath with narrow, membranous, even or ciliolate margins. Blade rotund or ovate, varying to lanceolate, abruptly acute or acuminate and cuspidate at the apex, rounded or cordate at the base, smooth on the margins or often erosely denticulate as well as on the nerves beneath and on the petiole (especially in var. *crenulata*, Small and Heller), 2′–6′ long and 10″–6′ wide, 5-nerved, or sometimes with an obscure marginal nerve on each side, also often lineolate and always punctate. The young leaves are usually quite thin, while the older are coriaceous, green and shining on both surfaces. The oldest often become very large, orbicular, and remain evergreen on the plant over winter. Peduncles 3″–12″ long, flattened, 6–25–flowered. Peclicels 1″–4″ long. Flowers greenish yellow. Perianth segments oblong, acute, often 1–nerved, pubescent at the tip and sometimes along the edges, about 2″ long. Anther about ½ as long as the filament or less. Stigmas 3, linear, as long or nearly as long as the ovary; ovary 3-celled, each cell 2-ovuled. Berries from 5 to 8 in number, bluish-black, globose, about 3″ in diameter, 1–3-seeded.

A peculiar form was collected by the late Dr. Vasey in Washington, D. C., which has rather thin, exactly orbicular leaves, 2¼′ in diameter, male perianth with segments 3″–3½″ long, ⅓ to ½ longer than the stamens, some of the anthers as long as the filament, female flowers with segments 2″ long, and an ovary apparently with only 1 ovule in each cell.

Dry or moist thickets. Ontario to Florida and Texas, west to Arkansas and Minnesota. April–June.

6. SMILAX HISPIDA Muhl.; Torr. Fl. N. Y. 2: 302 (1843).

Smilax hispida Muhl. Cat. (1813), name only.

Glabrous. Stem terete below, subterete or angular on the branches, commonly thickly hispid with numerous slender, straight spines of different lengths, which are often black, occasionally flat, sometimes 4″ long. Petiole 4″–9″ long, rarely denticulate, the stipular sheath with broad membranous denticulate margins covering from ⅓ to ½ half its length. Blade thin, green on both sides, broad-ovate, obtuse or subcordate at baes, cuneate at the petiole, abruptly acute and cuspidate at the apex, rarely destitute of denticulations on the margins and nerves beneath, lineolate, 7–9-nerved, 2′-5′ long, 1′–4¾′ wide. Peduncles

9″–2′ long, flattened, 10–26-flowered. Pedicels slender, 2″–3″ long. Flowers greenish-yellow. Segments of male perianth elliptical or oblong-obovate, acute, 2″ long, slightly longer than the stamens. Stamens 6 or 7; anthers a little shorter than the filament. Female flowers 8–10; stigmas somewhat shorter than the ovary. Fruiting pedicels 3″–4″ long; receptacle barely 1″ in diameter, without bracteoles. Berries 5 or 6 in number, globose, bluish-black, about 3″ in diameter. M. DeCandolle gives the receptacle as 5 mm. in diameter, but in none of our specimens are they over 1″.

Low or high ground and rocky places. Ontario to Virginia, Louisiana and Texas, west to Minnesota and Nebraska. May–July.

7. Smilax Californica A. Gray in Brew. and Wats. Bot. Cal. 2: 186 (1880).

Smilax rotundifolia var. *Californica* A. DC. Monog. Phan. 1: 75 (1878).

First collected by Hartweg (No. 2011) in the Sacramento Valley, California, in 1846–7, and noted in Benth. Pl. Hart. 341 (Dec. 1848) as "*Smilax rotundifolia* L.?"

Glabrous. Stem angled, often quadrangular on the branches, armed with scattered or numerous small weak black and bristly spines of different lengths. Petioles 2″–5″ long; stipular sheath with narrow smooth or ciliolate margins, ½ the length of the petiole. Blade thin, broadly ovate and cordate at base, or in the younger leaves lanceolate and rounded or somewhat acute at base, acute or abruptly cuspidate at the apex, entire or slightly erose-denticulate on the margins, lineolate, 5–7-nerved, 2′–5′ long and 9″–3½′ broad. Peduncles compressed, 8″–14″ long, 5–20-flowered. Pedicels 3″–4″ long. Flowers greenish-yellow. Segments of male perianth elliptical, 1- or obscurely 3-nerved, acute, 2″ long. Anthers ½ as long as the filament. Berries bluish-black, 5–15 in number, globose, about 3″ in diameter, 1–2 seeded.

McCloud's River and Butte and Humboldt counties, California; Kerbyville, Josephine county, Oregon (Thomas Howell).

8. Smilax Pseudo-China L. Sp. Pl. 1031 (1753).

Smilax hederæfolia Mill. Dict. fide A. DC. Monog. Phan. 1: 82.

Glabrous. Rootstock tuberous. Stem terete, branches angled, the lower part of them often beset with numerous straight needle-shaped prickles, the upper part and the branches unarmed or with occasional spines. Petioles 3″–12″ long; stipular sheath with even, smooth or ciliolate margins, ⅓–½ the length of the petiole, nearly always bearing tendrils. Blade rather thin, green on both sides, or sometimes glaucous beneath, ovate or round-ovate, often contracted in the middle or lobed at the base, obtuse cordate or subcordate at base, acute or cuspidate at the apex, commonly strongly lineolate, smooth or often bristly denticulate on the margins and nerves below, 2½′–4¾′ long and 1½′–3½′ broad, 7–9-nerved, occasionally in orbicular forms with 1 or 2 additional nerves on each side. The leaves on old plants sometimes become quite thick, orbicular in shape and 4′ or 5′ in diameter, or even broader than long. Peduncles flattened, 1′–3′ long, 12–40-flowered. Pedicels 3″–4″ long. Segments of male perianth oblong-ovate, acute, 2½″ long; stamens 6–10; anther as long as or longer than the filament. Buds oval in shape. Segments of female flowers elliptical, 1″–1½″ long. Berries black, 8–16 in number, globose, 2″–3″ in diameter, 1–3-seeded, on irregularly shaped receptacles 1″–2″ in diameter and apparently ebracteolate.

Smilax Pseudo-China may be distinguished from *S. hispida*, with which it is liable to be confounded, by its usually more numerous flowers and fruit, its stouter and longer peduncles, the frequent absence of prickles, which are never so numerous as in *hispida*, the firmer texture of the leaves, and the more prominent and generally more numerous nerves, the 3 middle ones running more closely together. Besides this the blades of *S. hispida* are seldom or never strictly cordate at the base, and never contracted or lobed, as sometimes occurs in *S. Pseudo-China*.

Dry or sandy soil. District of Columbia to Florida and Texas, west to Arkansas and Nebraska. March–August.

9. SMILAX BONA-NOX L. Sp. Pl. 1030 (1753).

Smilax Bona-nox β L. 1030 (1753).

Smilax hastata Willd. Sp. Pl. 4: 782 (1806).

Smilax pandurata Pursh, Fl. Am. Sept. 251 (1814).

Smilax tamnoides A. Gray, Man. Ed. 1, 485 (1848), not L.

Smilax hederæfolia (not Miller) and *S. senticosa*, Kunth, Enum. 5: 209 (1850).

Rootstocks tuberous; Dr. Burrows (MS. in Torr. Herb.) states that the Indians in Florida make them into meal and use it for bread or in soup, under the name "Coonte." Glabrous. Stem terete or slightly angled below; branches angled, often square. Prickles scattered or numerous, often stipular, often wanting on the branches, stout or occasionally acicular. Petiole 3″–6″ long, often spiny; stipular sheath ⅓ to ½ its length and frequently denticulate on the margins. Blade mostly coriaceous, sometimes rather thin, varying from broad-ovate to (more commonly) deltoid-hastate, hastate or panduriform (*S. pandurata* Pursh), green or shining on both sides, smooth or often denticulate or spiny on the margins and nerves beneath, especially in the southern hastate forms (*S. hastata* Willd., *S. bona-nox* β L.), acute or abruptly cuspidate at the apex, obtuse truncate cordate or semicordate at the base, pellucidly punctate and lineolate, 5–9-nerved, 1½′–4½′ long, 8″–2½′ wide. Peduncles slender, compressed, 7″–14″ long, 15–45-flowered. Pedicels 2″–4″ long. Segments of male perianth lanceolate, 2″–2½″ long; anthers as long as the filaments. Segments of female perianth 1″ long; ovary 3-celled, often only 1-ovuled; stigmas 1–3. Berries black, globular, 8–20 in number, 2″–3″ in diameter, mostly 1-seeded.

The leaves of this species are very variable in shape. They are sometimes merely ovate with an obtuse, abruptly cuspidate tip, more commonly deltoid-hastate with broad, rounded lobes at the base, sometimes constricted above the lobes, acute and cuspidate at the apex, running from this into narrow, hastate forms, with projecting, rounded lobes at the base, and an oblong, narrow, terminal lobe, the apex obtuse or acute and cuspidate. These narrow forms, are sometimes only 6″ broad across the basal lobes, and 3″ in width on the terminal lobe, and are often quite spiny-bristly on the margins. Others again are fiddle-shaped, with 2 broad, rounded lobes at the base, expanding above the contracted middle into a broad obtuse and cuspidate or acute upper lobe. The venation is often somewhat peculiar, the main reticulations being oblong, beginning low down on the blade, giving the appearance of a multitude of basal nerves, with secondary nerves as prominent as the primary. The nerves are 5–7 on the terminal lobe, and often from 2 to 4 additional ones on the basal lobes. The margins have a raised callous edge.

In specimens collected by Dr. Gattinger in Tennessee (Herb. University of Tenn.), the stem exhibits in places little cushions or pads of stellate hairs, and large flat spines having the same kind of hairs upon them. In these instances the branches are flexuous, with short nodes, as in *S. rotundifolia*. In other cases I have seen forms with these stellate hairs on the nerves of the leaf, and at the extremities of the spines, swamps and thickets.

Nantucket, Mass., to Florida and Texas, west to Missouri and Kansas. April–July.

10. Smilax Beyrichii Kunth, Enum. 5: 207 (1850).

Smilax ovata Ell. Bot. S. C. and Ga. 698 (1824), not Pursh.

Smilax auriculata Chapm. Fl. S. States, 476 (1860), not Walt. (?)

The name here given is adopted by M. De Candolle on the ground of the uncertainty attending the *S. auriculata* of Walter, but is by no means certain that this is not Walter's species, as his description, so far as it goes, applies very well, except that it may be doubtful what he means by "purple" berries.

Glabrous. Stem terete or obscurely angled below; branches angled, often square, flexuous. Spines rather stout, scattered, commonly wanting on the branches. Petioles 2″–6″ long, usually as long as or longer than the peduncles; stipular sheath with straight, even or ciliolate edges, occupying ½ or even more of the petiole. Blade thick, coriaceous, shining on both sides, strongly reticulated, varying from ovate, oblong-ovate and lanceolate to bilobate or dilated below, nearly always cuneate or acute at the base and acute and cuspidate at the apex, smooth on the margins and nerves, lineolate, the larger with 5–7 and the smaller with 3 nerves, 10″–4½′ long, 4″–2′ wide. The leaves are normally auriculate, but the lobes are often reduced to a basal dilatation or disappear altogether, leaving a lanceolate form. Peduncles stout, angled, 2″–5″ long, 7–40-flowered. Pedicels 3″–5″ long. Receptacle globose, 1″–2″ in diameter; bracteoles acuminate, ciliolate. Flower clusters numerous, fragrant. Segment of male perianth oblong-lanceolate, 2″–2½″ long; anthers usually ⅓ as long as the filament, sometimes ½ as long. Segments of female perianth 1½′ long; ovary 3-celled; 1 ovule in each cell; stigmas 3. Berries black, globose, 2″–3″ in diameter, 1–3-seeded.

M. De Candolle well notes that the scales of the lower branches are situated a little distance above the base of the branch, and not at the base as in other species.

A low, straggling species common in sand along the coast, trailing or running over small bushes, remarkable for the agreeable odor of its flowers. North Carolina to Florida and Alabama. Flowers, May–July. Fruit, November.

11. Smilax Smallii Morong. n. sp.

Glabrous. Stem and branches terete, striate, unarmed, mostly lying upon the ground, 6 to 8 feet in length, the tendrils grasping grasses and weeds. Petiole 2″–5″ long; stipular sheath with narrow membranous smooth-edged margins ⅔ as long as the petiole. Blade light green, shining above, obtuse or acute at the base, abruptly narrowing into an obtuse tip, sparsely lineolate, 5-nerved, 1½′–2¼′ long, 10″–1¾′ wide. Pedicels very unequal, 1″–4″ long. Receptacle small, globular; bracteoles minute, triangular. Segments of male perianth narrowly oblanceolate, 2″ long, about the length of the stamens; stamens 6; anthers ⅓ the length of the filament. Female flowers and fruit not seen.

Collected in the sand on the northern slope of the Stone Mountain, Georgia, July 17, 1893, by Mr. John K. Small, in whose honor it is here named.

‡‡ **Fruit ripening the second year.**

12. SMILAX LAURIFOLIA L. Sp. Pl. 1030 (1753).

Glabrous. Stem climbing high, stout, terete, striate, armed with strong straight prickles; branches angular, unarmed. Petiole stout, striate, 3″–8″ long; stipular sheath with even or ciliolate margins, ⅓ to ½ as long as the petiole. Blade thick, coriaceous, evergreen, feebly shining above, varying from elliptical to oblong-lanceolate, acute at base, acute or abruptly cuspidate at apex, smooth on the margins, minutely pellucid-punctate, 3-nerved, occasionally with an obscure marginal nerve on each side, 2′–4½′ long, 6″–2′ broad. Extreme forms with linear leaves 5½′ long and 3″ wide (var. *bupleurifolia* Delile) were collected by M. A. Curtis in South Carolina, and others 7′ long and 5½′ wide, from Florida, are in the herb. of Dr. Chapman. Peduncle usually shorter than the petiole, 2″–10″ long, stout, angled, 6–30-flowered. Pedicels 2″–3″ long. Receptacle globular, 1″–2″ in diameter; bracteoles minute, ovate. Segments of male perianth oblong, 2½″–3″ long; stamens a little shorter; anthers usually about ⅓ shorter than the filaments. Female flowers with oblong segments, 1½″–2″ long, 6 staminodia, an ovary commonly 1-rarely 2-celled, and with 1, rarely 2 stigmas. Berries black, ovoid, 2″–3″ in diameter, mostly 1-seeded, 8-12 in number, not maturing until the second year.

Swamps and moist thickets. Pine barrens, New Jersey to Florida, west to Texas and Arkansas. March–September.

†† **Berries red.**

13. SMILAX PUMILA Walt. Fl. Car. 244 (1788).

Smilax pubera Michx. Fl. Bor. Am. 2: 238 (1803).

Smilax puberula Kunth, Enum. 5: 193 (1850).

Rootstock tuberous, tubers small, sometimes massed together at base of stem, throwing out fibrous roots. Stem terete, unarmed, clothed with fuscous or rufescent pubescence, 1°–3° high, simple or sparingly branched. Petiole terete, 2″–7″ long, hairy; stipular sheath ¼–½ of the petiole, also pubescent, as well as the tendrils. Blade ovate or sometimes oval, acute and mucronate at the apex, cordate at base, softly white-pubescent beneath, scantily hairy or glabrous and shining above, pellucid-punctate and occasionally lineolate, 3–5-nerved, 2′–4′ long, 10″–2½′ wide. Peduncles 2″–8″ long, pubescent, 6–30-flowered. Pedicels 1″ long. Receptacle globose, very hairy, 1″–1½″ broad. Bud oblong-obovate, often scantily hairy. Segments of male perianth oblong, 1″–1½″ long, about the length of the stamens; anthers ⅓ the length of the filaments. Segments of female flower 1″ long; ovary ovoid, 1-celled, 1-ovuled; stigma solitary. Berries red, ovoid, pointed, 2½″–4″ long, 2″–2½″ broad, containing a single large oval light-yellow seed, maturing the second year.*

Dry, sandy soil and woodlands. South Carolina to Florida and Louisiana.

14. SMILAX HAVANENSIS Jacq. Amer. 262, *t. 179, f. 102* (1763).

Smilax dentata Willd. Sp. Pl. 4: 774 (1806).

Glabrous. Stem angled, flexuous, armed with numerous small stout hooked prickles; internodes short; often a low straggling vine, and often climbing high ("to the tops of trees," Blodgett). Sometimes the stems are naked or very sparsely armed. Petioles 1″–3″ long, about equal to the peduncle; stipular sheath with smooth or ciliate, sometimes sparsely bristly margins, occupying nearly the whole length of the petiole. Blade rigid, roundish, ovate, elliptical or mostly oblong, narrowed or rounded, occasionally subcordate at the base, mucronate at the apex, or often emarginate as well as mucronate, commonly spiny on the callous-nerved margins and often so on the midrib beneath, opaque, 3–5-nerved, or 7-nerved from the base, 1′–2′ long, 4″–14″ wide, increasing in the older leaves to 4′ by 2¼′. Peduncles thick, angled, 1″–2″ long, or often apparently none, 4–30-flowered. Pedicels ½″–1″ long. Receptacle 1″–3″ broad, depressed, globose; bracteoles minute, ovate or acuminate. Segments of the male perianth, which I have not seen, are, according to M. De Candolle, ½″–¾″ long, oblong; stamens ½ shorter; anthers the length of the filament. The female flowers have segments ½″ long; ovary 3-celled, 2–3-ovuled; stigmas 2–3. Berries globose, 2″–3″ in diameter.

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* We owe our knowledge of this fact to Mr. E. E. Sterns whose articles in Bull. Torr. Club, 15: 162 and elsewhere contain matters of great interest in regard to various species of *Smilax*. It is to be regretted that the expressed intention of this acute observer to publish a revision of the North American species was never carried into effect.

I have not seen fresh berries; they are described as being red. Dried herbarium specimens at Columbia College are old and faded, but have a ruddy tinge. M. De Candolle says that they blacken in drying. Grisebach* calls them "purple."

The plant has migrated from the West Indies, where it is common, and has been collected by Rugel and A. H. Curtiss near the coast in Southern Florida, by Blodgett at Key West, and by Simpson on Little Pine Key. Extends into Mexico. Flowers, March.

SMILAX WALTERI Pursh, Fl. Am. Sept. 249 (1814).

Smilax caduca, Ell. Bot. S. C. & Ga. **2**: 701 (1824), not L.

Glabrous. Stem angled, prickly near the base; branches often square, commonly unarmed. Petioles 2″–6″ long, stout, angular; stipular sheath ¼–⅓ the length of the petiole, the margins often denticulate. Blade broad-ovate, lanceolate, rarely obtusely 2-lobed at the base (as in specimens collected by A. H. Curtiss, near Jacksonville, Florida, No. 2863), cordate, subcordate, rounded or abruptly acute at base, cuspidate at the apex, smooth on the margins, sparsely lineolate, 5–7-nerved, 2′–5′ long, 10″–3¼′ wide. Peduncles 2″–5″ long, flattened, thickening with age, 6–15-flowered. Receptacle depressed-globose, 1½″ broad, or often quite irregular in shape; bracteoles few, acuminate. Pedicels very slender, 2″–3″ long. Segments of male perianth oblong, 3″–4″ long, ¼–⅓ longer than the stamens. Anthers ¼–⅓ shorter than the filaments. Female flowers with perianth segments 1½″–2″ long, ovary 3-celled, 3-ovuled. Berries coral red, globose, 3″–4″ in diameter, 2–3-seeded, maturing the first year.

Pine barrens and swamps. New Jersey to Florida, Tennessee and Louisiana. Flowers, April–June. Fruit, September–November.

16. SMILAX LANCEOLATA L. Sp. Pl. 1031 (1753).

Smilax ovata Pursh, Fl. Am. Sept. 249 (1814).

Glabrous. Stem and branches terete, branchlets subangular, mostly unarmed; climbing over trees sometimes for 30 feet. Petiole 1″–2″ long; stipular sheath about ½ the length of the petiole, margins narrow, parallel, entire or ciliolate. Blade usually rather thin in texture, ovate or more commonly lanceolate, acute at the base, acute or acuminate at the apex, smooth on the margins, shining above, sparingly lineolate, 5–7-nerved, 2′–3½′ long, 6″–20″ wide. Peduncles thick, angled, 3″–8″ long, 8–40-flowered.

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* Fl. Brit. W. I. Islands, 586.

Pedicels 2″–7″ long. Receptacle globose, about 1″ broad, or sometimes conical and 2″ long. Pedicels 2″–2½″ long, inserted among ovate or acuminate ciliolate bracteoles. Segments of male perianth narrow, oblong, acute, about 2″ long; anthers shorter than the filaments. Female flowers not seen. Ovary 3-celled, 3-ovuled; stigmas 3. Berries dark red, globose, 2″–3″ in diameter, usually 2-seeded, 4–10 in number, maturing the first year.

The reduction of *S. ovata*, Pursh to this species is made on the authority of Dr. Asa Gray, who, as appears from manuscript notes in the Harvard Herbarium, examined in 1881 the specimens in the Herbaria of Enslen and Sherard upon which Pursh founded his species, and declares positively that they are *Smilax lanceolata.* M. De Candolle in his monograph retains *Smilax ovata* and *S. lanceolata* as distinct species, but he appears to have based his *ovata* principally upon the description of Elliott, and specimens from Elliott in Herb. Webb. There cannot be much doubt, however, that the *ovata* of Elliott is an ovate-leaved form of *S. Beyrichii* Kunth.

Virginia to Florida, west to Arkansas and Texas, March–August.

17. **SMILAX MEGACARPA** Morong n. sp.

Glabrous, excepting traces of a fine white pubescence on some of the scales beneath the branches. Stem terete, striate; branches angular or subangular, a little flexuous. Petiole 2″–4″ long, thick, striate; stipular sheath from ¼ to ½ its length, with narrow ciliolate or smooth parallel margins. Blade thick, coriaceous, elliptical, rounded or sloping at base, obtuse and abruptly acute or cuspidate at the apex, dull green on both sides, margins smooth, nerves not prominent, 5–7, the midnerves often apparently made up of 2 or 3, the lateral ones branching off from it above, minutely pellucid-punctate, but not lineolate, the smaller 2½′–3′ long and 6″–1′ broad, the larger 3½′–4′ long and 1½′–2′ broad. The leaves strongly resemble those of *S. laurifolia* in shape, color and texture. Peduncles of old umbels, from which the flowers have fallen are ½″–2″ long, thick, angular, the empty foveolæ apparently 6–10 in number; fruiting peduncles flattened, 6″–8″ long. Pedicels 3″–4″ long. Receptacle irregular in shape or globose, 1″–1½″ broad. Flowers not seen. Berries globose, red, 4–6 in number, very large, 3″–5″ in diameter, 3-seeded.

This plant was collected in fruit only by Capt. John Donnell Smith, February 11, 1882, in swamps, Duval County, Florida.

It does not agree either with *S. laurifolia* or *S. lanceolata*, to both of which it bears a resemblance in certain particulars.

Mexican and Central American Species.

1. Smilax acutifolia Schlecht. Linnæa, **18**: 449 (1844).

Very smooth and glabrous. A plant apparently unarmed, with subcoriaceous, curvilinear-acuminate blades, broadly rounded at the base, 5–7-nerved, 3¾′–4¾′ long and 1¼′–2½′ broad at the base. Peduncles always longer than the petiole. Pedicels ½ as long as the peduncles. Berries depressed sub-globose, 5″ in diameter.

South Mexico, near Angangueo (Schiede) and near El Banco (Ehrenberg).

2. Smilax angustiflora A. DC. Monog. Phan. **1**: 67 (1878).

Rufescent-tomentose. Blades ovate-oblong, broadly cordate at base, not shining, 7-nerved, 4½′–5′ long, 1½′–2′ broad. Male peduncles 7″–10″ long, 20–40-flowered. Female flowers and fruit not known. Distinguishable from *S. tomentosa* by its paler color, its thinner, less ovate and duller blades with a broader sinus, its longer peduncles, very narrow buds and blunt anthers.

Costa Rica, at Alto de la Cruz, near Azari (Hoffman).

3. Smilax aristolochiæfolia Mill. Gard. Dict. Ed. 8, No. 7 (1768).

S. Milleri Steud. Nomencl. Bot.

All that is known of this species is given by Miller, who describes the stem as climbing 30–40 feet, and the blades as thick, rigid, unarmed, tri-nerved, 7′ long and auricled at the base.

Near Vera Cruz, Mexico.

4. Smilax Bona-nox Wrightii A. DC.

The form with ovate-acute blades, round-lobed at the base.

Mexico, without locality (Pavon), near Jalapa (Galeotti) and Zinapan (Coulter).

5. Smilax Bona-nox senticosa A. DC.

Form with rigid, often aculeate blades, nerves or petiole often aculeate, and fruit-bearing peduncles twice as long as the petiole.

South Mexico, near Puente de Dios (Ehrenberg), Orizaba and Huatasco (F. Müller).

6. Smilax Botterii A. DC. Monog. Phan. **1**: 89 (1878).

Glabrous. Lower branches quadrangular, armed with scattered short black prickles. Petioles 2″–4″ long; stipular sheath nearly ½ the length of the petiole, margins denticulate or smooth. Blade oblong-ovate, acute or somewhat obtuse at base, or when older cordate, shining above, pellucid-punctate and lineolate, 7–9-nerved, the younger 1½′–2½′ long, the older 2¾′–3½′ long and about as broad. Peduncles 2″–5″ long, 20–30-flowered. Ovary obovoid, 3-sulcate. Stigmas 3, linear, obtuse, erect or recurved, about ¼ as long as the ovary. Younger fruit only known, the berries are borne on pedicels about 5″ long.

This species when the quadrangular branches are not seen is, according to A. DC., difficult to separate from *S. invenusta* and *S. Moranensis*.

Mexico, around Orizaba (Botteri, No. 467), and the valley of Mexico (Bourgeau, Nos. 237 and 1131).

7. SMILAX CANDELARIÆ A. DC. Monog. Phan. **1**: 70 (1878).

Branches terete, the younger densely rufescent-tomentose, at last glabrate. Petioles 3″–5″ long, pubescent; stipular sheath ⅓–½ the length of the petiole. Blade oval, oblong or ovate-acute, obtuse at base and later subcordate, pubescent beneath, sparsely tomentose on the nerves above, 7–11-nerved, opaque, 3½′–8½′ long, 1¼′–4¾′ broad. Flowers unknown. Fruit-bearing peduncles 1″ long, tomentose. Pedicels 4″–5″ long, pilose. Berries black, globose, nearly 5″ in diameter, 1–3-seeded.

8. SMILAX COGNATA Kunth, Enum. **5**: 175 (1850).

Attributed by Kunth to Puerto Alegro, Mexico, is regarded by A. DC. as probably confined to Brazil, since no such place as Puerto Alegro is known in Mexico, and Kunth's specimens were cutivated at Berlin.

9. SMILAX CORDIFOLIA H. and B.; Willd. Sp. Pl. **4**: 778 (1806).

Branches flexuous, subterete or angular, commonly unarmed, clothed, as also the leaves with white evanescent hairs. Petiole 4″–5″ long; stipular sheath ¼–⅓ length of petiole, the margins denticulate. Blade firm but not coriaceous, ovate-acute, cordate and broadly rounded at the base, cuneate near the petiole, mucronate at the apex, 7–9-nerved, 2½′–3¼′ long, 1½′–2¾′ broad. Peduncles 5″–9″ long, 8–24-flowered. Pedicels 2″–3″ long, inserted among very small lanceolate bracteoles. Receptacle globose, ½″–1″ in diameter. Berries black, 1–2-seeded, 2–7 in number.

South Mexico, near Jalapa, La Bandanilla, Papantla and other places.

10. **Smilax densiflora** A. DC. Monog. Phan. 1: 88 (1878).

Glabrous. Unarmed. Branches terete, or the upper angled and striate. Petioles 2″–5″ long. Blade ovate-acuminate, obtuse or subcordate at base, the margins slightly erose-denticulate, 5-nerved, 1¼′–2′ long, 7″–10″ broad. Peduncles 2″–7″ long, densely 10–12-flowered. Berries not known.

Mexico, Province of Toluca.

11. **Smilax densiflora Christmarensis** A. DC.

Blade 7-nerved; peduncles twice as long as the petiole.

South Mexico, around San Miguel.

12. **Smilax discolor** Schlecht. Linnæa, 18: 454 (1844).

Very smooth and glabrous. Stems subterete, the branches subangular and glaucescent, rarely armed. Petioles 4″–6″ long. Blade oval, dilated at base or elongated-triangular, acute at the apex, pruinose or white-glaucescent beneath, 5-nerved, 2¼′–3¼′ long, 1′–2½′ broad, sometimes increasing to 10′ or 12′ long and 3′ broad at the base. Peduncles 8″–12″ long, compressed, angulate. Pedicels 3″ long. Fruit not known.

13. **Smilax Domingensis** Willd. Sp. Pl. 4: 783 (1806).

Specimens apparently belonging to this species are in the Herbarium of Capt. John Donnell Smith, though not cited by De Candolle or Hemsley as occuring in Mexico. They correspond very fairly with Wright's Cuban plants in the Herbarium of Columbia College, and almost precisely with De Candolle's description of the species.

Glabrous. Branches terete below, subangular above, unarmed. Petiole 4″–7″ long; stipular sheath about ¼ the length of the petiole. Blade elliptical, acute at base, acute or acuminate at the apex, shining on the upper surface, pellucidly punctate, 5–7-nerved, the marginal nerves closely approximate, 2½′–3½′ long, 8″–22″ broad. Peduncles 1″–2″ long, thick, angled, 10–20-flowered. Receptacle globose; bracteoles minute, acuminate, ciliolate. Pedicels of male flowers about 2″ long; bud ovoid or oblanceolate; segments of perianth elliptical, obtuse, 2″ long; anthers much shorter than the filaments. Berries black, globose, on pedicels 3″–4″ long, about 2″ in diameter.

Collected by Botteri at Orizaba. Common in St. Domingo and Cuba.

14. **Smilax erythrocarpa** Kunth, Enum. 5: 234 (1850).

Glabrous. Stems terete, unarmed, or sometimes remotely armed with small straight prickles. Petioles 8″–10″ long. Blade coriaceous, oblong-ovate, cordate or obtuse at the base, short-acuminate, 7-nerved, 3¼′–4′ long, 1½′–2′ broad. Distinguished from all other Mexican species, according to Kunth, by the length of its peduncles, which are nearly 2½′ long. Berries red, shorter than the pedicels.

15. SMILAX GLAUCA Walt. Fl. Car. (1788).

South Mexico, near Oaxaca and at Zongolica.

16. SMILAX GLAUCOCARPA Schlecht. Linnæa, **18**: 450 (1844).

Stem very smooth, terete, sparsely armed. Petiole 2″–3″ long. Blade with rounded or narrowed base, subfalcate, very narrowly acuminate, glaucous-green, 5-nerved, 2½′–3¼′ long, 9″–14″ broad at the base. Male flowers unknown. Female pedicels 1″–2″ long; the perianth segments about 1″ long. This seems to be a doubtful species, as no specimens are found in any European or American Herbarium.

According to Schlechtendal, occurring at the Hacienda del Carmen and Mineral del Monte, in South Mexico.

17. SMILAX HAVANENSIS Jacq.

South Mexico, mountains west of Jalapa.

18. SMILAX HISPIDA Torr.

Assigned doubtfully to Mexico by Hemsley.

19. SMILAX INVENUSTA Kunth, Enum. **5**: 234 (1850).

Glabrous. Stem terete, unarmed. Petiole 4″–18″ long; stipular sheath with very narrow margins, ¼–⅓ the length of the petiole. Blade ovate, oval or elliptical, rounded, sometimes cordate or subcordate at base, margins entire, 7–9-nerved, 3′–6′ long, 1½′–4′ broad. Specimens in the Harvard Herbarium collected by Botteri at Orizaba, have flexuous and angled branches, and ovate-lanceolate, subcordate blades 4½′ long and 2½′ wide. Peduncles angular, often compressed, 4″–7″ long. Pedicels nearly filiform, 2″–4″ long. Male flowers with very narrow, elliptical, acute segments, 2½″–3″ long; filaments about the length of the anthers; Berries black, globose, 1–2-seeded, 6–8 in number.

South Mexico, near Orizaba and Jalapa. Guatemala, near Coban, Coll. Lehman (Herb. J. D. Smith).

20. SMILAX INVENUSTA ARMATA A. DC.

A form with occasional prickles on the flower-bearing branches and branchlets.

More common than the type. South Mexico, Jalapa; Guatamala, Coban (Herb. J. D. Smith).

21. Smilax Jalapensis Schlecht. Linnæa, **18**: 447 (1844).

Very smooth. Stem terete, sparingly furnished with prickles. Petiole ahout 6″ long. Blade broad-ovate, rounded or subcordate at base, acuminate, glaucous-green underneath, 7-nerved, 1¼′-3′ long, 1′–2½′ wide. Peduncles 8″ 11″ long. Pedicels 3″–4″ long. Ripe fruit unknown.

South Mexico, Jalapa.

22. Smilax medica Schlecht. Linnæa, **18**: 447 (1844).

Rhizome consisting of a large crown of consolidated tubers, which throw out a number of stems, and numerous roots 1″–2″ in thickness and sometimes 3 feet long. These roots are pressed over the crown, dried and exported under the commercial name, "Vera Cruz Sarsaparilla."

Glabrous. Stems bluntly angular, armed with short stout prickles; branches very flexuous, sub-terete or angular, commonly unarmed. Petioles 5″–2′ long, occasionally bearing a few straight prickles; stipular sheath with narrow wings, ⅓–½ as long as the petiole. Blade ovate-hastate or oblong-hastate, cordate, with rounded lobes, often slightly constricted above the lobes, varying to oblong-elliptical with an acute base, acute at apex, pellucid-punctate and lineolate, 5–7-nerved or sometimes with 1 or 2 additional marginal nerves on each side, 4′–8′ long, 2′–4½′ broad. Peduncles compressed, 5″–12″ long, 8–25-flowered, often rising from the axils of the bracts (var. *bracteata* A. DC.). Pedicels flattened, 4″–5″ long. Berries red, globose, about the length of the pedicel, often 3-seeded.

South Mexico, Rafantla and near Tantoyuca, Orizaba and elsewhere.

23. Smilax Mexicana Kunth, Enum. **5**: 167 (1850).

Glabrous. Branches flexuous, angular, sparsely armed with recurved prickles. Petiole 3″–7″. Blade thick, coriaceous, elliptical-ovate, rounded or subcordate at base, acute or acuminate and mucronate at the apex, here and there spiny on the midnerve beneath, 5–7-nerved, 2′–4½′ long, 8″–2¼′ wide. Old leaves are sometimes nearly oval, 4′ long and nearly 3′ broad, abruptly acute. Peduncles 1″–3″ long, 10–50-flowered. Pedicels 1″–3″ long. Berries black, 3–6 in number, 1–2-seeded.

South Mexico, near Tampico, Misantla and Colipa. Guatemala, Acatepeque (Herb. J. D. Smith).

24. Smilax Mexicana Costaricæ A. DC.

Leaves always unarmed. Flowers said to be intensely red and fragrant.

Mexico, Vera Cruz (F. Müller), Orizaba, Tampico, Misantla and other places. Costa Rica, near San Jose. Panama.

25. SMILAX MOLLIS Willd. Sp. Pl. 4: 785 (1806).

All the parts densely clothed with soft rufescent hairs, the leaves becoming glabrate. Stem slender, terete, unarmed. Petiole stout, 5″–7″ long. Blade elliptical, ovate or oblong-ovate, cordate, acute or obtuse and mucronate at the apex, 7–9-nerved, 3′–5′ long, 1¾′–3′ broad. Specimens in Columbia College Herbarium, collected by Dr. Halsted near Jalapa, Mexico, have oblong-lanceolate, acute blades, 3¼′–10¾′ long and 1′–1¾′ wide. Peduncles stout, terete, 5″–10″ long, or even 14″, densely 20–50-flowered. Pedicels ½″–1″ long. Bud of male flower obovoid, acute at the base, sometimes furnished with long hairs. Berries said to be red when fresh, appearing black in herbarium specimens.

South Mexico, Orizaba, Jalapa and elsewhere. Common in the West Indies.

26. SMILAX MORANENSIS Mart. & Gal. Bull. Acad. Brux. 9: 2 (1842).

Rhizome small, scarcely distinct from the lower part of the stem. Glabrous. Stem terete, armed. Petiole 2″–3″, or sometimes 8″ long. Blade more or less ovate, obtuse or subcordate at base, long lanceolate, with an acute tip, margins erose-denticulate, 5–7-nerved, 2′–3½′ long, 5″–19″ broad. Peduncle 2″–6″ long, 9–15-flowered. Pedicels 2″–4″ long. Receptacle scarcely ¼″ broad, ebracteolate. Berries black, globose, 2″–3″ broad.

Mexico, between Chico and Chapula, on the peak of Orizaba and near the city of Mexico.

27. SMILAX MULTIFLORA, Mart. & Gal. Bull. Acad. Brux. 9: 2 (1842).

Stem terete, unarmed. Petiole 1′ long. Blade ovate, subacuminate, triple-nerved. Umbels densely many-flowered. Peduncles 2″–3″ long, scarcely longer than the petiole.

Placed by De Candolle among "species dubiæ."

Said to have been collected in the woods at Chinantla, Province of Oaxaca.

28. SMILAX OBTUSA Benth. Bot. Voy. Sulph. 175 (1845).

Glabrous. Branches angular, unarmed. Petiole 2″–5″ long. Blade coriaceous, oblong, more or less obtuse at base, obtuse and often mucronulate at the apex, 5-nerved, 1¼′–2½′ long and 5″–

6″ broad. Peduncle about equal to the petiole. Berries globose, shortly pedicellate, 2″ in diameter.

Scarcely to be separated from S. *Wagneriana*, which see. Manzanilla Bay, Mexico.

29. SMILAX OFFICINALIS H. B. K. Nov. Gen. 1: 271 (1815).

Rootstock large and long, tuberous or with thickened nodes whence proceed numerous roots, 6–8 feet long, which form the officinal or "Jamaica" Sarsaparilla of commerce.

Glabrous. Stems numerous from the same rootstock, angular, armed with curved prickles; branches flexuous, cylindrical at first, becoming strongly quadrangular, armed like the stem or often unarmed. Petiole 2″–6″, becoming sometimes 2′ long, often twisted, quadrangular, often armed with a few straight prickles beneath. Blade coriaceous, oblong-ovate, cordate, abruptly acute or obtuse with a small hard central point at the apex, 7-nerved, 5′–8′ long, 2′–2½′ wide, the old leaves sometimes reaching a length of 12′ and a breadth of 6½′. Flowers and fruit not known.

Attributed to Mexico by Presl. Panama, Volcan de Chiriqui.

30. SMILAX PANAMENSIS Morong n. sp.

Stem terete, unarmed, slightly pubescent here and there, in specimens examined the female plant manifestly rusty-pubescent, especially at the nodes, as well as on the peduncles and tendrils, becoming glabrate; branches flexuous. Pedicels 6″–8″ long; stipular sheath about ⅓ as long as the petiole, with narrow, even wings, often tendril-bearing. Blades glabrous, oblong-ovate or lanceolate, rounded, acute or semi-cordate at the base, entire, pellucid-punctate, 5–7-nerved, the older ones 4′–5½′ long, 1½′–2½′ broad. Male peduncle flattened, solitary, sometimes 2–3-branched or often 2 or 3 from the same axil, 8″–12″ long, frequently bearing scales, 8–10-flowered. Pedicels very slender, flattened, 2″–5″ long. Receptacles globose, ½″–1″ in diameter; bracteoles acuminate, ciliolate. Flower buds elliptical, about 2″ long; segments of perianth elliptical, acute or obtuse, 2″–3″ long; stamens 5 and 6, included; anthers a little longer than the filaments. Fruit-bearing peduncle terete, occasionally pubescent, 12″–14″ long, and judging from the foveolæ 30–40-flowered. Margins of the foveolæ and the bracteoles woolly-pubescent. Berries ovoid, 4″–5″ long, black with a reddish tinge in the dried specimens, 1-seeded. As the male flowers were collected in October and the fully ripe fruit in November of the same year, it would suggest the probability that the berries ripen in the second year.

Collected by S. Hayes (No. 63, 68 and 209) at the Gatun Station on the Panama Railway, October and November, 1859.

31. Smilax papyracea Duham. Arb. Ed. Mich. 1: 242 (1801).

Rhizome thickened at the summit with tubers, about 10″ thick, sending off long roots into the ground. These according to Grisebach (Mart. Fl. Bras. 3: Pt. 2, 5) furnish the Brazilian Sarsaparilla, known in common as "Para" or "Lisbon Sarsaparilla."

Glabrous. Stem sharply quadrangular or 5–6 angled, thickly beset with scale-like prickles upon the angles. Petiole 5″–10″ long. Blade papyraceous in texture, oblong-elliptical, rounded or subcordate at base, cuneate at the petiole, acuminate-cuspidate at the apex, 5-nerved, 4′–6½′ long, 2′–4′ long. Flowers and fruit unknown.

Guatemala, Volcan de Fuego.

32. Smilax rotundifolia L.

According to De Candolle, collected in Mexico by Pavon, locality not given, specimens apparently of this species are in the Herbarium of Columbia College, ex herb. John Donnell Smith, collected by Heyde and Lux at San Miguel Uspatan, Guatemala, No. 3526.

33. Smilax Schlechtendalii Kunth, Enum. 5: 224 (1850).

Glabrous. Stem stout, terete, striate, unarmed; branches terete or angular, slightly flexuous. Petiole 4″–6″ long; stipular sheath about ⅓ the length of the petiole, the margins narrow and ciliolate. Blade coriaceous, lanceolate or oblong-ovate, cuneate at the petiole, abruptly acuminate at the apex, pellucidly punctate, 5-nerved or with an additional marginal nerve on each side, 2½′–4′ long, 1¼′–2′ broad, the marginal nerves closely approximate. De Candolle states that the leaves are shining on the upper surface. They are dull in the specimens which I have examined. The reticulations are remarkably small and close. Peduncles angular-extremely short, sometimes apparently none, the longest fruits bearing peduncles less than 1″ long, 8–30 flowered. Pedicels 3″–6″ long. Berries black in herbarium specimens, globose, 3″–4″, broad, 2–3-seeded.

Reported from Orizaba, Valley of Cordova and other places in Mexico. Specimens in Herb. John Donnell Smith, Coll. E. Kerber at Fortin, near Orizaba, March, 1883 (No. 361).

34. Smilax spinosa Mill Gard. Dict. no. 8 (1768), not Poir.

This is said to have a terete, unarmed stem, ovate-lanceolate leaves, the nerves spiny, about 4½′ long and 2½′ wide, but it is regarded as a doubtful species by De. Candolle.

South Mexico, near Vera Cruz.

35. SMILAX SUBPUBESCENS A. DC. Monog. Phan. 1 : 69 (1878).

Branches unarmed or furnished with short, straight prickles, the lower terete and glabrous, the upper angular and pubescent at the extremities. Petioles 7″–9″ long. Blade coriaceous, glabrous, ovate-acuminate, obtuse or subcordate at base, acuminate at the apex, pellucid-punctate and sparingly lineolate, 7–9-nerved, 2¼′–3½′ long, 1′–2′ broad. Fruit-bearing peduncles 4″–8″ long, red-pubescent, at length glabrate, 5–7-fruited. Pedicels 5″ long, puberulent. Berries globose, 3″–4″ in diameter.

Fruiting specimens which appear to belong to this species are in the herbarium of John Donnell Smith, collected by Kerner (no. 188), at Atoyac, in the Province of Vera Cruz, Mexico. In this case the lower portions of the branches as well as the petioles exhibit a rufous pubescence, which, however, disappears in time, leaving them glabrate. The blades are all subcordate, and strongly lineolate. Berries 6–10. M. De Candolle does not indicate the color of the fruit, but in these specimens the berries have a decidedly reddish tinge, and yield 2–3 seeds.

South Mexico, region of Orizaba.

36. SMILAX TOMENTOSA H. B. K. Nov. Gen. 1: 272 (1815).

Stem terete, unarmed, the younger branches fulvous-tomentose, becoming glabrate. Petioles 2″–3″ long, the older ones becoming 9″–12″ in length. Tendrils pubescent. Blade coriaceous, pubescent above, ferruginous-tomentose beneath, cordate-ovate, acuminate, pellucid-punctate but not lineolate, 9-nerved, the younger 2′–3½′ long and 9″–2⅓ broad, becoming with age 5′ long and 3½′ broad. Male peduncle 1″–2″ long, tomentose, 30–40-flowered. Pedicels 3″–4″ long, the younger tomentose. Female peduncle longer, and the pedicels slightly shorter than in the male. Berries unknown.

Panama, Volcan de Chiriqui.

37. SMILAX WAGNERIANA A. D. C. Monog. Phan. 1: 143 (1878).

Glabrous. Branches smooth, angular, unarmed. Petiole 2″–5″ long. Blade subrigid, ovate-lanceolate, rarely oblong, acute or later obtuse at the base, narrowed or obtuse-mucronulate at the apex, opaque, 5-nerved, 2′–3¼′ long, 7″–12″ broad. Male peduncle ⅓″–1″ long, 25–35-flowered. Pedicels very slender, 2″–3″ long. Female flowers and berries unknown.

Panama, Province of Chiriqui.

A preliminary Revision of the Genus Lathyrus in North and Central America.

BY THEODORE G. WHITE.

The following is an attempt to correlate and classify the various descriptions and herbarium material of North American *Lathyri*. Much confusion has existed in the determination of specimens of this genus up to the present time, and evidently the species thus far defined are not sufficent to embrace all the material collected.

From the fact that each collection so far examined has afforded so many developments, we are certain that much interesting material awaits description. The present abstract is published in the hope of bringing forth additional material and notes from collectors in the field, especially in the West and Southwest, before the work is completed. Such information will be most gratefully received.

Only two attempts have previously been made to enumerate the species of the genus. The first was by Alefeld (Bonplandia, June, 1861), who placed all the American species in the genus *Orobus;* the second, by Watson (Am. Jour. Sci., Feb., 1876), who enumerated thirteen species; while several additional species, chiefly by Prof. Greene and by Dr. Watson have since been publshed.

I am indebted to Prof. N. L. Britton for guidance throughout, and for the use of collections placed at my disposal by Columbia College, Harvard University, United States Department of Agriculture and the University of California, which have been examined as well as several private herbaria.

LATHYRUS L. Sp. Pl. 733 (1753).

Stem erect or climbing by mostly trifid tendrils; stipules variably semi-sagittate; leaves abruptly pinnate, of 1–7 pairs of leaflets; leaflets mucronate; peduncles axillary; the raceme shorter than, equalling or exceeding the leaves; corolla papilionaceous, campanulate at base and not funnel-form as in *Vicia;* wings free from or only slightly adherent to the middle of the keel, while those of *Vicia* are adherent; sheath of the filaments cylindrical and cut off abruptly at right angles, and not oblique at the apex; stamens

10, diadelphous; style transversely flattened, but not grooved down the back, as in *Pisum*, ascending and bent upward obtusely or nearly at right angles with the ovary, dilated at summit and longitudinally bearded on the inner face, next the free stamen, for ⅓–½ its length, *not* acute and bearded cylindrically at the tip as in *Vicia*, sometimes twisted so as to appear reversed, persistent; calyx campanulate, dilated, not funnel-form as in *Vicia*, 5-toothed; legumes oblong, compressed, 2-valved, 1-celled, many-ovuled; seeds globular or angular.

Artificial Key to the Species.

- Leaflets a single pair.
  - Annual; racemes 1-2-flowered; flowers purple, 1. *L. pusillus.*
  - Perennial; racemes 4–10-flowered; flowers yellow, 2. *L. pratensis.*
- Leaflets 2–several pairs.
  - Stems winged.
    - Leaflets 3 pairs, glabrous or pubescent; racemes 2–6-flowered, 3. *L. palustris.*
    - Leaflets 4–6-paired; pubescent; racemes 6–15-flowered, 4. *L. Watsoni.*
    - Leaflets 4–6 pairs; glabrous, coriaceous, ; racemes 6–15-flowered, 5. *L. Jepsoni.*
  - Stems wingless.
    - Plants glabrous, puberulent or pubescent, not villous.
      - Climbing by simple or 3-forked tendrils.
        - Stipules large, mostly half as large as adjacent leaflets.
          - Leaflets 2–5 (mostly 3) pairs.
            - Flowers cream-colored, 6. *L. ochroleucus.*
            - Flowers purple.
              - Racemes 2–6-flowered.
                - Leaflets membranaceous.
                  - Flowers less than 1–5 cm. long, 7. *L. myrtifolius*
                  - Flowers at least 2 cm. long, 8. *L. pauciflorus.*
                - Leaflets coriaceous, 19. *L. parvifolius.*
              - Racemes many-flowered, 9. *L. Bolanderi.*
          - Leaflets 5–7 pairs.
            - Flowers yellow, 10. *L. sulphureus.*
            - Flowers purple.
              - Raceme exceeeding the rachis of its leaf, 11. *L. Alefeldi.*
              - Raceme not exceeding the rachis of its leaf.
                - Glabrous, flaccid, leaflets 5–8 pairs, 12. *L. polyphyllus.*
                - Glabrous, rigid, leaflets 4–6 pairs, 13. *L. maritimus.*
                - Pubescent; leaflets 5–7 pairs, 14. *L. vestitus.*
        - Stipules small or minute, not half as large as adjacent leaflet.
          - Flowers white, 15. *L. laetiflorus.*
          - Flowers purple, 2.5–3.5 cm. long.

Stipules entire, 27. *L. decaphyllus.*
Stipules incised or laciniate.
Flowers 3–3.5 cm. long, 16. *L. splendens.*
Flowers 2.5–3 cm. long, 10. *L. Alefeldi.*
Flowers purple, less than 2 cm. long.
Calyx-teeth nearly as long as the tube, 17. *L. violaceus.*
Calyx-teeth shorter than the tube.
Leaflets coriaceous.
Leaflets linear-lanceolate, 18. *L. coriaceus.*
Leaflets ovate, oval or oblong, 19. *L. parvifolius.*
Leaflets membranaceous.
Leaflets 5–7 pairs, broad, 20. *L. venosus.*
Leaflets 2–4 pairs.
Leaflets oblong or linear, 2–4 cm. long.
Peduncle equaling or shorter than its leaf, 7. *L. myrtifolius.*
Peduncle much exceeding its leaf, 21. *L. longipes.*
Leaflets narrowly linear, 4–12 cm. long, 22. *L. graminifolius.*
Erect or nearly so; tendrils 0 or much reduced.
Flowers 2 or more, white or yellowish.
Flowers about 1 cm. long; leaflets mostly 2 pairs (rarely 3), 23. *L. Arizonicus.*
Flowers 2 cm. or more long.
Leaflets narrowly lanceolate, much longer than wide, 24. *L. Cusickii.*
Leaflets oblong, lanceolate or obovate, 2–4 times as long as wide.
Leaflets oblong or obovate; stipules minute, 25. *L. obovatus.*
Leaflets oblong-lanceolate; stipules nearly as large, 26. *L. rigidus.*
Flowers 2 or more, purple.
Leaflets 3–7 pairs.
Flowers 1.5–3 cm. long.
Leaflets coriaceous.
Leaflets 1–4 mm. wide. 27. *L. ornatus.*
Leaflets 5–10 mm. wide. 28. *L. decaphyllus.*
Leaflets membranaceous. 29. *L. Nuttallii.*
Flowers 1–1.5 cm. long. 30. *L. Oregonensis.*
Leaflets 1–2 pairs, 31 *L. bijugatus.*
Single-flowered; flowers purple; leaflets 4–5 pairs, 32. *L. Torreyi.*
Plant densely silky-villous all over, 33. *L. littoralis.*

1. LATHYRUS PUSILLUS Ell. Bot. S. C. & Ga. 2: 223 (1824).
Lathyrus Engelmanii Bisch. Sem. Hort. Heidel (1839).

South Carolina to Florida, west to Arkansas and Texas.

Original locality: Cooper River, St. John's Parish, S. C.

Resembles *L. angulatus* L. of Southern Europe, but that species has more nearly linear leaflets and smaller stipules.

2. LATHYRUS PRATENSIS L. Sp. Pl. 733 (1753).

Massachusetts and New York, naturalized from Europe.

Original locality: European.

3. LATHYRUS PALUSTRIS L. Sp. Pl. 733 (1853).

Lathyrus Lanszwertii Kell. Proc. Cal. Acad. **2**: 150, *fig. 44* (1863).

Lathyrus occidentalis Nutt. = *L. palustris* var. β, T. & G. Fl. N. A. **1**: 276 (1838).

New York and New England westward through the Northern States and Canada to Alaska.

Original locality: European.

A species of Northern Europe, Asia and North America; characterized from various allied species, especially *L. myrtifolius* Muhl., with which it has been confused by American authors, by (1) the prominently winged stem, the wings often as broad or broader than the stem; (2) the longer narrower more coriaceous dark green foliage; (3) the more lanceolate acutely semi-sagittate stipules; (4) the few flowered raceme.*

4. LATHYRUS WATSONI White.

Lathyrus venosus Muhl. vars. γ and δ Torr. Pac. R. R. Rept. **4**: 76 (1857).

Lathyrus venosus var. *Californicus* S. Wats. Proc. Am. Acad. **11**: 133 (1876), not *L. Californicus* Dougl.

Lathyrus Californicus S. Wats. Proc. Am. Acad. **20**: 363 (1885).

Perennial, rather lax, velvety pubescent throughout; stem very stout, flexous, quadrangular, usually strongly winged, striate, branching, 1–2 m. high; stipules semi-sagittate, dilated and often coarsely toothed at base, long acuminate, the upper mostly narrower, ⅓–⅛ as long as the leaflets; pedicels often channeled; leaflets 8–12 sub-alternate, ovate-oblong to linear-lanceolate, 1–5 cm. long, obtuse to acuminate, rather thick, paler beneath, densely soft pubescent on both surfaces, as is also the rachis; tendrils short, branching; peduncles stout, equalling the leaves, 6–15 flowered; flowers 13–18 mm. long, pink turning to yellow when old, calyx pubescent and much dilated, the upper pair of teeth very short, the lateral ones acuminate and longer, the lower lanceolate and nearly as long as the calyx-tube; legume linear, attenuate at base to a stipe, 5 cm. long by 3 cm. broad. Grows near water. May.

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* Note distinction of characters of *L. palustris* and *L. myrtifolius* by Alefeld, Botanische Zeitung **18**: 161 (May 4, 1860).

California, types from Monterey and from Sonoma Co., J. Torrey (1865).

Type in Gray Herb., dupl. in Herb. Col. Coll.

5. LATHYRUS JEPSONII Greene, Pittonia, **2**: 158 (1890).

Lathyrus palustris L. var. ε., T. & G. Fl. N. A. **1**: 276 (1838).

California. Original locality: Suisan Marshes, Solano Co., W. L. Jepson (1890).

Type in Herb. Univ. Cal., duplicate in Herb. Col. Coll.

6. LATHYRUS OCHROLEUCUS Hook. Fl. Bor.-Am. **1**: 159 (1831–33).

Lathyrus pisiformis Willd. var. (?) Richardson. Frankl. Exp. 2d Ed., App. 28 (1823).

Lathyrus glaucifolius Beck. Bot. 90 (1833).

Lathyrus albidus Aitkin; Eaton, Man. Ed. 6, 198 (1833).

Orobus ochroleucus A. Braun, Ind. Sem. h. Berol. (1853.)

New York and New Jersey, north and westward to Washington and British Columbia.

Original locality: Northern British America.

7. LATHYRUS MYRTIFOLIUS Muhl.; Willd. Sp. Pl. **3**: 1091 (1803).

Lathyrus stipulaceus Le Conte; Torr. Cat. Pl. N. Y. 92 (1819).

Lathyrus Altiacus Ledeb. Fl. Altai. **3**: 355 (1831).

Lathyrus decaphyllus var. *minor* Hook. and Arn. Bot. Beechey Exp. 138 (1841).

Orobus myrtifolius Alefeld, Bot. Zeit. **18**: 162 (1860).

Manitoba and Ontario southward to Tennessee, east of the Mississippi.

Original locality: Pennsylvania.

7a. LATHYRUS MYRTIFOLIUS MACRANTHUS n. var.

Lathyrus palustris η T. & G. Fl. N. A. **1**: 276 (1838–40).

Pubescent throughout; stem wingless, stouter, but more flexuose than in the type; stipules broadly semi-sagittate, fully half the length of the leaflets, acuminate at both ends; leaflets elliptical, obtuse, 3–3.5 cm. long, ⅓ as wide, very thin, pale green; racheme exceeding the rachis of its leaf, 4–5-flowered; flowers large (2–2.5 cm. long); calyx-teeth linear-lanceolate or linear, very acute, the lateral ones equalling the tube, while the lower exceed it.

Original locality: Lubeck, Quoddy Head, Maine; (N. E. extremity of U. S.), Oakes.

Type in Herb. Col. Coll.

8. LATHYRUS PAUCIFLORUS Fernald, Bot. Gaz. **19**: 335 (1894).

Lathyrus polyphyllus S. Wats. Bot. King's Exp. 78 (1871), not Nutt.

Lathyrus palustris var. *myrtifolius* S. Wats. Bibl. Index, **1**: 230 (1878), in part.

Washington, Oregon, Utah [Wahsatch Mts., Watson (n. 296) L. F. Ward, etc.] and Idaho [Ketchum and Silver City, Miss A. I. Mulford (1894).]

Original localities: Roseburg, Oregon, Thos. Howell, 1887 (n. 677); Wawawai, Washington, Lake & Hull, 1892 (n. 810); Snake River Cañon, Washington, C. V. Piper, 1893 (n. 1487).

Types in Gray Herb.

9. LATHYRUS BOLANDERI S. Wats. Proc. Am. Acad. **20**: 363 (1885).

Oregon and California.

Original locality: Oakland Hills near San Francisco, Torrey, 1865.

Type in Gray Herb.; duplicate in Herb. Col. Coll.

10. LATHYRUS SULPHUREUS Brewer; A. Gray, Proc. Am. Acad. **7**: 399 (1867).

Lathyrus ochroleucus var. Torr. Pac. R. R. Rep. **4**: 77 (1857).

Lathyrus venosus Torr. Pac. R. R. Rep. **4**: 77 (1857), in part.

Washington, Oregon and California.

Original localities: Auburn, Duffield's Ranch, etc., Cal.

Types in Gray Herb. and Herb. Col. Coll.

11. LATHYRUS ALEFELDI White.

Orobus Californicus Alef. Bonplandia, **9**: 146 (1861), excl. syn., not *Lathyrus Californicus* Dougl.

Perennial; glabrous or sparingly pubescent throughout; stem rather stout, flexuous, quadrangular, wingless, scarcely striate between the angles; stipules semi-cordate, acuminate, thick and strongly reticulated, ⅓–½ as long as the leaflets, and often nearly as broad, the lower lobe very coarsely acuminately toothed, leaflets 6–10, alternate or in pairs, oblong to ovate or obovate, obtuse, frequently retuse, thick and stiff, prominently reticulated, glabrous on both surfaces, 1.5–4 cm. long, ½–⅓ as broad; tendrils long, stout and trifid; peduncle 6–10-flowered, twice as long as the corresponding leaf; flowers large 2–3 cm. long; corolla purple (?), pedicels longer than the calyx-tube, calyx dilated, pubescent, particularly on the margin; upper calyx-teeth broadly triangular, acute, lateral pair oblong-lanceolate, and the lowest coriaceous, subulate, the three lower teeth equalling the tube, the upper shorter; legume flat, sparingly pubescent, about 8-seeded. May.

California.

Original locality: San Diego, Cal., Geo. Thurber (n. 574), labeled "L. venosus Muhl."

Type in Herb. Col. Coll., duplicate in Gray Herb.

The species is readily distinguished by its wingless stem, large, coarsely toothed stipules; thick, broadly elliptical, glabrous, reticulate leaflets; very long, many-flowered peduncle and large flowers.

12. LATHYRUS POLYPHYLLUS Nutt.; T. & G. Fl. N. A. 1; 274 (1838).

Northern Pacific Coast and Manitoba.

Original locality: Oregon.

Type in Herb. Col. Coll.

13. LATHYRUS MARITIMUS (L.) Bigel. Fl. Bost. Ed. 2, 268 (1824).

Pisum maritimum L. Sp. Pl. 727 (1753).

Lathyrus Californicus Dougl.; Lindl. Bot. Reg. 14: *t. 1144* (1828).

Orobus maritimus Reichenb. Fl. Exc. 538 (1830–32).

Lathyrus venosus Sweet, Brit. Fl. Gard. 1: *t. 37* (1831), not of Muhl. nor Willd.

Lathyrus pisiformis Hook. Fl. Bor. Am. 1: 158 (1831–33).

Coasts of Labrador to New Jersey, shores of the Great Lakes, Washington and Alaska.

Original locality: European.

13a. LATHYRUS MARITIMUS ALEUTICUS Greene, ined.

Nearly erect, 12–30 cm. high; stems slender; stipules as in the type, as large or larger than the leaflets; stipules and leaflets thin, pubescent on the lower surface, glabrous above; leaflets 2–5 pairs, thin and rotund or elliptical, not obovate as in the type, nearly always opposite, seldom over 1.5 cm. long, ½–⅔ as wide; tendrils usually reduced to a short bristle or rudimentary terminal leaflet. Calyx teeth very long and broad.

This is probably the low plant alluded to by Hooker, Fl. Bor. Am. 1: 159 under *L. pisiformis.* A fairly constant variety of the North Pacific coasts, Alaska, Japan, Kamtschatka, the Commander Islands, etc.

Original locality: Alaska.

Types in Herb. Univ. Cal.; duplicates in Herb. Col. Coll.

14. LATHYRUS VESTITUS Nutt.; Torr. & Gray, Fl. N. A. 1: 276 (1838).

Original locality: Oregon, "Columbia plains toward the sea," Nuttall.

Type in Herb. Col. Coll.

A large quantity of western material has been assigned to this species by collectors and authors, none of which has so far been found to agree with Nuttall's description or his own type specimen, in regard to the short peduncle, numerous small leaflets glabrous only on the upper surface, and the broad stipules of very nearly equal size with the leaflets.

15. LATHYRUS LÆTIFLORUS Greene, Erythea, 1: 105 (1893).

California, Los Angeles and Santa Clara Cos.

Type raised from seed from Los Angeles Co. Cal., in botanic garden of Univ. of Cal.

Type in Herb. Univ. Cal., duplicate in Herb. Col. Coll.

16. LATHYRUS SPLENDENS Kellogg, Proc. Cal. Acad. Sci. 7: 90 (1876).

Lathyrus venosus var. *grandiflorus* Torr. Pac. R. R. Rept. 77 (1857), not *L. grandiflorus* Sibth. & Smith.

Original locality: Southern California. (J. M. Hutchings).

California and Lower California.

17. LATHYRUS VIOLACEUS Greene, Erythea, 1: 105 (1893).

Lathyrus puberulus White; Greene, Man. 85 (1894).

Southern California.

Type of *L. violaceus* raised from seed from the mountains of Los Angeles Co., Cal.

Types of *L. violaceus* and *L. puberulus* in both Herb. Univ. Cal. and Herb. Col. Coll.

The author's provisional manuscript name of *L. puberulus* was adopted by Prof. Greene in his Man. Bot. Reg. San Francisco, before we had seen the type of *L. violaceus* Greene. Since then Prof. Greene has kindly furnished us with fresh specimens of what he considers both species. Except in the smaller size of the specimens of *violaceus* submitted, its serrated rather than entire stipules, its darker foliage and that the lower calyx teeth are usually more drawn into a sinus, we distinguish, however, no specific characters sufficient to make "*puberulus*" a distinct species from *violaceus,* in either our types or the fresh material so far examined.

17a. LATHYRUS VIOLACEUS BARBERÆ n. var.

A narrowly leaved plant resembling this species more closely than any of the other related western ones occurs in Southern California and Northern Lower California. The variety has slender, wingless, much branched, climbing or creeping stems, glabrous or somewhat pubescent throughout; stipules minute, semi-sagittate, acuminate, lanceolate; leaflets linear-lanceolate, somewhat obtuse, 1–5 cm. long, 1–3 mm. broad, 4 pairs, alternate; peduncle somewhat longer than the leaf, 6–15-flowered; flowers 2 cm. long, reddish-purple, the banner veined with purple, as in the species; upper calyx teeth exceeding the tube, lateral ones broader and about the length of the tube, the lowest broad and much shorter.

California, Santa Barbara (1893), Dr. Wheelock; Kellogg and Harford (1868–9); Northern Lower California (1893), Miss Fish; San Quentin Bay (1889), Dr. E. Palmer (no. 670).

The variety, if not the whole species, is probably the same as *Lathyrus strictus* Nutt.; Torr. and Gray, Fl. N. A. 1: 276, from the same region (San Diego), but we have not seen the type of the latter.

18. LATHYRUS CORIACEUS n. sp.

Lathyrus palustris S. Wats. Bot. King's Exp. 79 (1871), not L.

Perennial; glabrous or minutely papillose throughout, 10–30 cm. high, stems rather stout, flexuous, quadrangular or terete, wingless, scarcely striate; stipules semi-sagittate, lanceolate, long-acuminate, in length up to half as long as the leaflets; leaflets 6–

12, sub-opposite, thick and coriaceous, strongly venulose on both surfaces, elliptical or linear-lanceolate, mostly obtuse, 3–6 cm. long, ⅓ as broad; tendrils short, mostly unbranched; receme shorter than the rachis of its leaf; flowers 3–10, clustered, probably purple, 1–1.5 cm. long; calyx teeth subequal, acute, shorter than the tube. Legume not seen.

A well marked species of the interior region, having the rigid appearance of *L. Jepsoni*, but wholly distinct from it. May–June.

Utah, Wahsatch Mts., alt. 5,000–7,000 ft. S. Watson (n. 297); Oregon, base of Stein's Mt. Thomas Howell, 1885.

Type (1) in Herb. Col. Coll.; (2) in Herb. U. S. Dept. Agric.

19. LATHYRUS PARVIFOLIUS S. Wats. Proc. Am. Acad. **17**: 345 (1882).

Lathyrus venosus var. *obovatus* Torr. Pac. R. R. Rep. **4**: 77 (1857), in part.

Throughout the region west of the Rocky Mountains, from Washington to Mexico.

Original locality: San Miguelito Mts., Mexico, Schaffner (n. 812); also Parry & Palmer (n. 197).

Types in Gray Herb.

20. LATHYRUS VENOSUS Muhl.; Wild. Sp. Pl. **3**: 1092 (1803).

Lathyrus decaphyllus Hook. Fl. Bor. Am. **1**: 159 (1833), not Pursh.

Lathyrus multiflorus Nutt.; T. & G. Fl. N. A. **1**: 274 (1838).

Orobus venosus A. Braun, Ind. Sem. h. Berol. (1853).

Lathyrus ochroleucus Torr. Pac. R. R. Rep. 267 (1858), not of Hook.

Orobus Muhlenbergii Alefeld, Bonplandia, **9**: 146 (1861).

Throughout the eastern half of the United States and Canada.

Original locality: Pennsylvania.

21. LATHYRUS LONGIPES n. sp.

Lathyrus venosus Hemsley, Bot. Cent. Amer. **1**: 293 (1879–1888), not Muhl.

Glabrous throughout; stems weak and slender, terete or quadrangular, wingless, not striate; stipules broadly semi-sagittate, acute at each end, thin, nearly entire, in length up to half the size of the leaflets; leaflets mostly three pairs, opposite, broadly elliptical, obtuse at each end, membranaceous, 2–4 cm. long, ½–⅓ as broad; tendrils long, filiform, branching; raceme 2–3 times longer than the rachis of its leaf, 4–6-flowered, slender; flowers purple, scarcely over 1.5 cm. long, clustered at the end of the peduncle; pedicels shorter than the calyx-tube; calyx teeth aeute, the three lower of about the same length, the upper pair much shorter and forming a sinus, all less than half the length of the tube. Legume not seen.

An apparently distinct species, although we have seen but one specimen.

Sierra Pedro Nolasco, Talea, etc. Mexico. C. Jurgensen (n. 817).

Type in Herb. Col. Coll.; communicated by Lindley.

22. LATHYRUS GRAMINIFOLIUS (S. Wats.) White.

Orobus dissitifolius Alefeld, Bonplandia, **9**: 145 (1861), excl. syn. not *L. dissitifolius* Nutt.

Lathyrus palustris var. *angustifolius* S. Wats. Biblio. Index, **1**: 230 (1878), not *L. angustifolius* Martr.

Lathyrus palustris var. *graminifolius* S. Wats. Proc. Am. Acad. **23**: 263 (1888).

Perennial, glabrous or sparingly pubescent throughout; stem rather slender, quadrangular, or terete, wingless, scarcely striate, branching, 15–60 cm. high; stipules minute, narrowly semi-sagittate, the lower lobe very short, entire, 0.5–1. cm. long; leaflets 4–8, scattered, 4–12 cm. long, linear 2–3 mm. broad; peduncles about the length of the leaves, 2–10-flowered; flowers loosely racemose, small, about 1 cm. long; corolla purplish, white with pink or yellow vexillum, variable in size and shade of color; calyx-teeth subequal, much shorter than the tube, triangular-acuminate, the lower forming a large, rounded sinus; legume compressed, 10–14-seeded. August.

Mexico, New Mexico, Arizona, California.

Original locality: Sonora, Mexico, Thurber (n. 1016).

Authentic specimen in Herb. Col. Coll.

23. LATHYRUS ARIZONICUS Britton; Trans. N. Y. Acad. Sci. **8**: 65 (1889).

Lathyrus palustris L. var. δ. T. & G. Fl. N. A. **1**: 276 (1838).

Arizona, Colorado.

A form from the mountain region of Colorado, Veta Pass, Sangre de Christo Range, G. H. Hicks (n. 19); North Pine, C. S. Sheldon (n. 104), has three pairs of leaflets, as well as two, white flowers and is otherwise apparently closely related to this species.

Original locality: Mehren's Ranch, Mogollon Mts. (1887), E. A. Mearns.

Type in Herb. Col. Coll.

24. LATHYRUS CUSICKII S. Wats. Proc. Am. Acad. **17**: 371 (1882).

Oregon and Arizona.

Original locality: Union Co., Oregon (1880), W. C. Cusick (n. 193).

Type in Gray Herb., duplicate in Herb. U. S. Dept. Agric.

25. LATHYRUS OBOVATUS (Torrey).

Lathyrus venosus var. *obovatus* Torr. Pac. R. R. Rep. **4**: 77 (1857), in part.

Lathyrus polymorphus var. 1. Hook. Lond. Journ. Bot. **6**: 207 (1847).

Vicia nana Kell. Proc. Cal. Acad. **7**: 89 (1876).

Lathyrus Nevadensis S. Wats. Proc. Am. Acad. **11**: 133 (1876).

Washington to California.

Original locality: Mammoth Grove and Duffield's Ranch, Sierra Nevada, Cal. (1853–54), Bigelow.

Type in Herb. Col. Coll., duplicate in Gray Herb. Type of *L. Nevadensis* in Gray Herb.

25a. LATHYRUS OBOVATUS STIPULACEUS n. var.

Glabrous, stipules broadly sub-cordate, ovate, obtuse, ⅓–½ the size of the leaflets; lower lobe dentate; raceme sometimes 10-flowered.

Colville to Spokane, Washington, Wilkes' Expedition (n. 592); Nachaco Valley (1877), Dawson.

26 LATHYRUS RIGIDUS White.

Lathyrus albus S. Wats. Bot. Cal. **2**: 442 (1880), not Kittel, Flora Deutschland.

Oregon.

Original locality: Union Co., Ore., W. C. Cusick.

Type in Gray Herb., dupl. in Herb. U. S. Dept. Agric.

27. LATHYRUS ORNATUS Nutt.; T. & G. Fl. N. A. **1**: 277 (1838).

Lathyrus polymorphus Torr. Ann. Lyc. N. Y. **2**: 180 (1827), not Nutt.

Wyoming, S. Dakota, Nebraska, Kansas, Indian Territory, Colorado and Utah.

Original locality: Kamassa prairies.

Type in Herb. Col. Coll.

28. Lathyrus decaphyllus Pursh, Fl. Am. Sept. 471 (1814).

Vicia stipulacea Pursh, Fl. Am. Sept. 739 (1814).

Lathyrus polymorphus Nutt. Genera, 2: 96 (1818).

Lathyrus myrtifolius Spreng. Syst. 3: 264 (1826), not of Willd.

Orobus polymorphus Alefeld, Bonplandia, 9: 146 (1861).

Idaho, Colorado, Arizona and New Mexico.

Original locality: Banks of the Missouri River.

This spiecies is very close to *L. ornatus* and differs from it chiefly in the size of the plant and its leaflets and in geographic distribution. Intermediate forms occur.

29. Lathyrus Nuttallii S. Wats.; Proc. Am. Acad. 21: 450 (1886).

Lathyrus venosus Muhl., *var. δ.* T. & G. Fl. N. A. 1: 274 (1838).

British Columbia, Washington, Oregon, California.

Original locality: "Upper California," Nuttall.

Type in Herb. Col. Coll. Duplicate in Gray Herb.

This species is very close in general appearance to *L. obovatus* but the distinction has been drawn on its being somewhat stouter, the leaflets narrower, and usually 4 pairs instead of 3 pairs, flowers smaller and purple instead of ochroleucous, and rachis tendril-bearing. Both species were formerly referred to the Eastern *venosus*, which, however, so far as I know, does not occur west of the Rocky Mountains.

30. Lathyrus Oregonensis n. sp.

Sparingly pubescent throughout, erect, 20–40 cm. high, flexuous, stem terete or quadrangular, wingless, rigid; stipules narrowly semi-saggitate or semi-hastate, acuminate at each end entire, the lower lobe often quite short, ⅓–¼ the length of the adjacent leaflets; leaflets mostly 4–7 pairs, opposite, lanceolate, obtuse, 1.5–4.5 cm. long, 2–8 mm. broad, coriaceous, sparingly pubescent on both surfaces; tendrils short, branched or reduced to a bristle; raceme 3–8-flowered, shorter than the rachis of its leaf; flowers apparently purple and veined, 1–1.5 cm. long; pedicel about the length of the calyx-tube; calyx-teeth subequal, the upper slightly shorter, all shorter than the tube; calyx-tube dilated, pubescent, purplish at base; legume compressed, abruptly terminated at apex, short-stipitate within the calyx, brown, 4–5 cm. long, ¼ as broad, 4–6-seeded; seeds brown, orbicular. April–June.

Oregon, at 3,000–4,000 ft. altitude, W. C. Cusick (1886), n. 1372; Falcon Valley, Washington, low dry grounds, W. N. Suksdorf (1885).

Types in Herb. U. S. Dept. Agric.

31. LATHYRUS BIJUGATUS n. sp.

Erect or slightly decumbent, 2–3 cm. high, glabrous throughout; stems slender, wingless, round or quadrangular, slightly flexuous; stipules minute, linear, subulate, semi-sagittate; leaflets 2 pairs, sometimes only 1 pair, elliptical to obovate, obtuse, thin, paler green beneath, 2–5 cm. long, ⅛–⅓ as broad; tendrils none or reduced to a very short bristle; raceme two-flowered, about the length of the rachis of its leaf; flowers purplish, about 1 cm. long, calyx-teeth very short, triangular, subequal, much shorter than the tube; legume brown, compressed, about 6-seeded. June.

Idaho, Latuh Co., J. H. Sandberg, 1892; Washington, between Colville and Spokane, Wilkes' Exp. (n. 572).

Type (1) in Herb. Col. Coll.; (2) in Herb. U. S. Dept. Agric.

31a. LATHYRUS BIJUGATUS SANDBERGI n. var.

Leaflets linear-lanceolate or spatulate, 5–9 cm. long, 1–2 mm. wide. Resembles extremely closely *L. tenuifolius* Roth, a species of the Mediterranean region.

Latuh Co., Idaho, J. H. Sandberg, 1892.

Type in Herb. Col. Coll.

32. LATHYRUS TORREYI A. Gray, Proc. Am. Acad. 7: 337 (1868.)

Lathyrus villosus Torr., Stevens' Pac. R. R. Rept. 4: 54 (1859), name only, not of Frivalds.

Washington, Oregon and California.

Original locality: Humboldt Co., Cal., Bolander (n. 6506) 1866.

Type in Herb Col. Coll.

33. LATHYRUS LITTORALIS Endl. in Walp. Rep. 1: 722 (1842).

Astrophia littoralis Nutt.; T. & G. Fl. N. A. 1: 278 (1838).

Orobus littoralis A. Gray; Stevens' Pac. R. R. Rep. 4: 54 (1859).

Washington, Oregon and California.

Original locality: Oregon.

Types of *Astrophia littoralis* and *Orobus littoralis* in Herb. Col. Coll.

Lathyrus Mexicanus Schl. Linnæa, **12**: Litb. 85 (1838).

"L. glaucescens, cirrhis diphyllis, foliolis lineari-lanceolatis oblongisve obtusis mucronatis trinerviis, pedunculis unifloris, folio longioribus, leguminibus compressis polyspermis. In tepid. ♃. Accepimus semen cum adnotatione: 'Lathyri species e Mexico.' Flores amœne purpurei, magnitudine *L. odorati*. Vereor tamen, ne *L. tingitanus*, cultura mutatus sit."—Schlechtendal.

"South Mexico, valley of Mexico (Bourgeau, 85) Herb. Kew. This is probably *L. tingitanus* L., an Old World species now widely diffused as an escape from cultivation."—Hemsley, Bot. Cent. Amer. **1**: 293.

Type not seen by the writer.

Lathyrus cinctus S. Wats. Proc. Am. Acad. **23**: 263 (1888) is *Vicia gigantea* Hook. Fl. Bor. Am. **1**: 157 (1830) as noted on type specimens in Gray Herb.

A new fossil Hepatic from the Lower Yellowstone in Montana.

By F. H. Knowlton.

[Plate 219.]

Preissites Wardii n. gen. et sp.

Thallus large, from 8–15 mm. long, and about 6 mm. broad, entire, or more commonly once or twice forked, provided with a distinct midrib which forks with the forking of the thallus, and along the sides of which are numerous vein-like lines caused by the overlapping scales of the lower surface; fruit unknown.

Hepaticæ in a fossil state are exceedingly rare, and the species here described represents, so far as I am now aware, the only extinct form known from North America. According to Mr. Arthur Hollick, of Columbia College, beautifully preserved specimens of the living *Marchantia polymorpha*, have been found in calcarious tufa, but there is every reason to suppose that they are of very recent origin.

In Europe, outside of a dozen more or less doubtful species of Jungermanniaceæ preserved in the Baltic amber, only six fossil species appear to have been thus far described: *Marchantia Sezanensis* Sap.,[1] closely allied to the living *M. polymorpha* L., from the oldest tertiary of Sézanne; *M. gracilis* Sap.,[2] allied to *M. linealis* Lindl., also from Sézanne; *M. sinuatus* Sap.,[3] from the Miocene of Marseilles; *M. dichtyophylla* Sap.,[4] from Aix, France; *Marchantites oolithicus* Fliche,[5] from the Lower Oolite of the vicinity of Nancy, France; and the recently described *Marchantites Zeilleri* Seward,[6] from the English Wealden. It is therefore interesting to find that this group of plants was early in existence in America as well as in Europe.

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[1] Fl. Foss. de Sez. 308, *pl. 1, figs. 1–8.*

This new American species is regarded as being allied to the genus *Preissia*, and I have made a new genus for its reception by the addition to the name of the living genus of the termination *-ites* to indicate its fossil state; yet it is with a good deal of hesitation that it is referred to this rather than to the evidently allied genus *Marchantia*. But taking *Marchantia polymorpha* as the type, very little can be found in the coarser structure of its thallus that would be likely, if it were fossilized, to give rise to the regular vein-like lines so prominent in the fossil form under consideration. On the other hand, the thallus of *Preissia commutata* is provided on the under side with scales that would be very likely to be preserved as lines if it should become fossilized. In the absence of fruit, however, it is unsafe to attempt positive conclusions on a purely vegetative character, and this determination is to be regarded as tentative.

In the accompanying figures (Plate 219, Figs. 1 and 2) the lines along the midvein appear stronger than they really are, and might easily be mistaken for veins. Their true nature is better shown in Fig. 3, where they are drawn as over-lapping scales. The specimens are small, not especially well preseved and hence in the drawings these lines are rather more prominent than they should be.

The specimens of this hepatic, all of which are figured, were collected by Prof. Lester F. Ward, of the U. S. Geological Survey, August 3–7, 1883, at Burns's Ranche, on the Lower Yellowstone,

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[2] Op. cit. 312, *pl. 1, fig. 9*.

[3] Ann. d. Sci. Nat. Bot. (V.) 3: 68, *pl. 1, fig. 2* (1865).

[4] Op. cit. 17: 6 [82], *pl. 1, fig. 3*; (1873) 18: 137 [235].

[5] Bull. d. Soc. d. Sci. Nancy (II.) 6: 16, *pl.* [not numbered] *figs. 1, 1¹* (1882).

[6] Cat. Mesoz. Pl. Brit. Mus., Wealden Flora Pt. i. 18, *pl. 1, fig. 3*.

30 miles below the town of Glendive, Montana. They come from strata usually referred to the Fort Union Group, but the beds appear, from the similarity of fossils as well as from their position at the base of the section, to be of the same horizon as the beds at Iron Bluff, which rest upon the Fox Hills Group. It is therefore possible, as Prof. Ward has pointed out (Bull. Geol. Soc. Am. **1**: 531), that these beds may represent the Laramie.

I take great pleasure in naming the species in honor of Prof. Ward, its collector.

Botanical Notes.

Steironema intermedium, Kearney.—Dr. Charles Mohr calls my attention to the fact that the form of this species collected by him in Talladega county, Alabama, differs from the type in having the stems decumbent or ascending.

In the figure of this plant published in the BULLETIN of the Torrey Club,* the staminodia were inadvertently omitted. These afford another excellent character for distinguishing the species. In *Steironema ciliatum* they are subulate-lanceolate, tapering from the base to the very acute apex. In *S. intermedium* they are of the same form, except that the apex is less subulate, but are from one-third to one-half as long. In *S. radicans*, finally, the sterile filaments are yet shorter and are comparatively broader and more abruptly pointed than in *S. intermedium.*

Gray (Syn. Fl. N. Am. **2**: Part 1, 61), describes the bottom of the corolla and the filaments of *Steironema* as "granulose-glandular." As these glands have distinct, though very short stalks, the term is not strictly applicable. In *S. radicans* the filaments are naked or with very few glands, while the corolla is much less glandular than in *S. ciliatum* and *S. intermedium.*

T. H. KEARNEY, JR.

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* Bull. Torr. Club, **21**: 264, *t. 209* (1894).

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The illustration is from a photograph of the tree as it appears in winter growing near the summit of San Pedro Martyr Mt. in Lower California.

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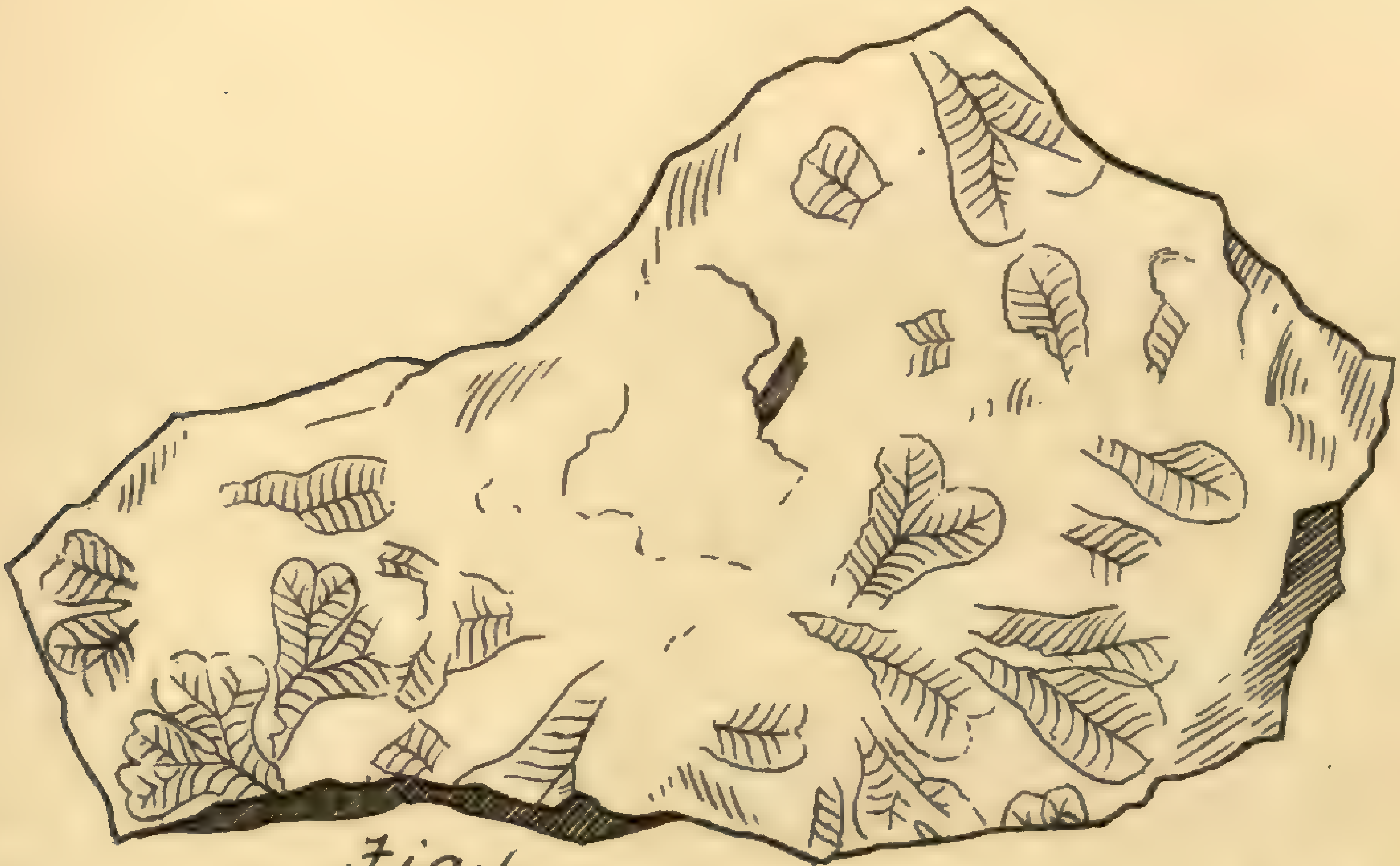

Fig. 1.

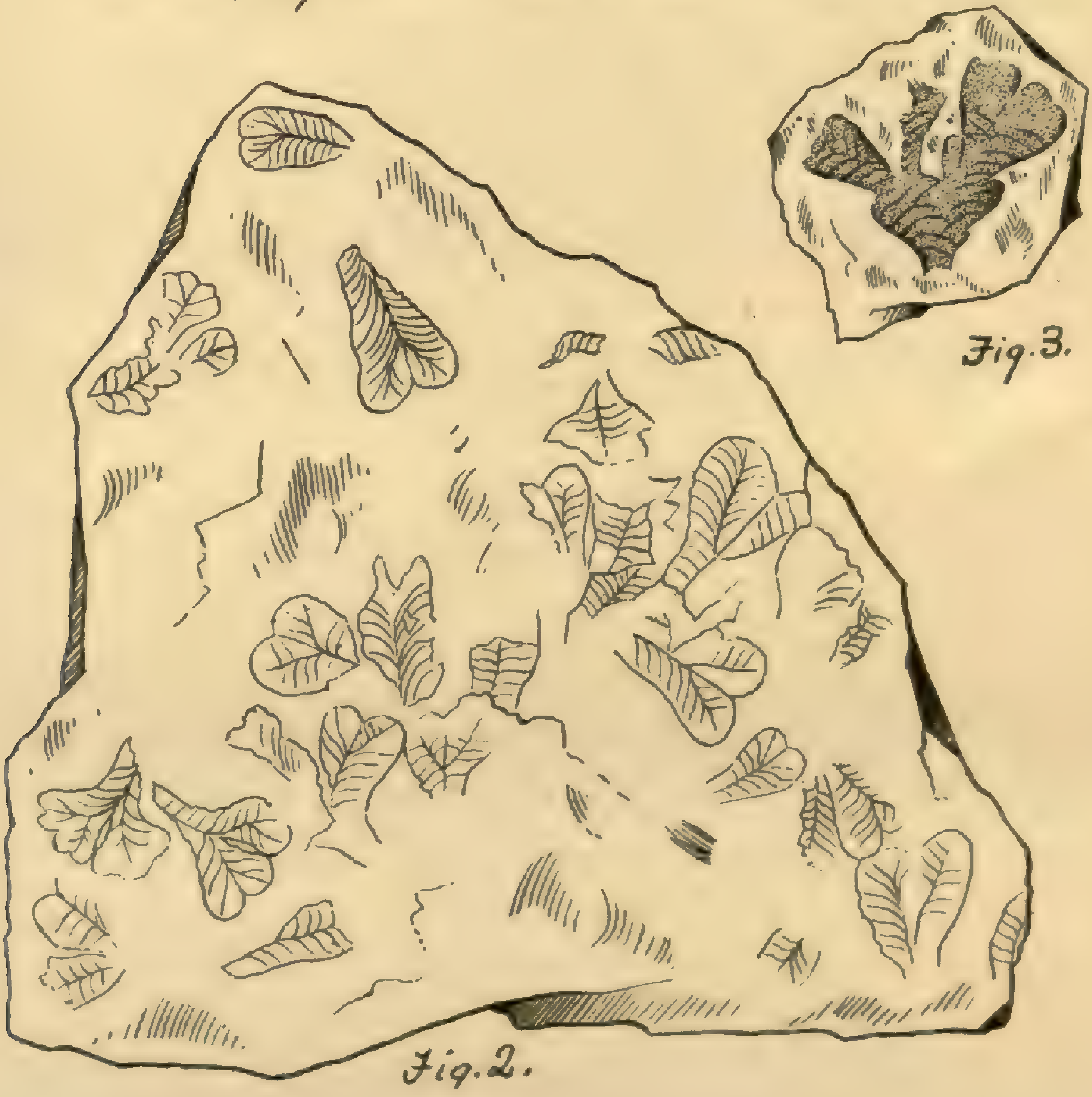

Fig. 3.

Fig. 2.

PREISSITES WARDII KNOWLTON.

Contributions from the Herbarium of Columbia College.

[The numbers omitted from this list are out of print.]

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No. 5. New or Noteworthy North American Phanerogams. By N. L. Britton (1888), ... 25 cents.

No. 6. An Enumeration of the Plants Collected by Dr. H. H. Rusby in South America, 1886–1887. By N. L. Britton. (Twenty-three parts published; not yet completed.)

No. 7. The Genus *Hicoria* of Rafinesque. By N. L. Britton (1888), . 25 cents.

No. 9. A List of Plants Collected by Dr. E. A. Mearns at Fort Verde and in the Mogollon and San Francisco Mountains, Arizona, 1884–1888. By N. L. Britton.

The General Floral Characters of the San Francisco and Mogollon Mountains and the Adjacent Region. By H. H. Rusby (1888), . . 25 cents.

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No. 13. New or Noteworthy North American Phanerogams, II. By N. L. Britton (1889), ... 25 cents.

No. 14. A List of State and Local Floras of the United States and British America, By N. L. Britton (1890), ... $1.

No. 15. A Descriptive List of Species of the Genus *Heuchera*. By Wm. E. Wheelock (1890), ... 25 cents.

No. 16. New or Noteworthy North American Phanerogams, III. By N. L. Britton (1890), ... 25 cents.

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VOL. 21. NOVEMBER, 1894. No. 11.

BULLETIN

OF THE

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A MONTHLY JOURNAL OF BOTANY.

EDITED BY

NATHANIEL LORD BRITTON,

AND OTHER MEMBERS OF THE CLUB.

CONTENTS:

PAGE.

Wing-like Appendages on the Petioles of *Liriophyllum populoides* Lesq. and *Liriodendron alatum* Newb., with Description of the latter: *Arthur Hollick* (PLATES 220 and 221) . . . 467

Two Species of *Oxalis*: *John K. Small* (PLATES 222 and 223) . . . 471

Notes on some of the rarer Species of *Polygonum*: *John K. Small* (PLATE 224) . 476

Some new Florida Plants: *T. H. Kearney, Jr.* . . . 482

Two new Genera of Plants from Bolivia: *H. H. Rusby* (PLATES 225 and 226) . . . 487

Cryptogamic Notes from Long Island—II.: *Smith Ely Jelliffe* . . . 489

PAGE.

BOTANICAL NOTES.—Pistillody; Staminody; Teratology: *F. L. Stevens*; Algæ Exsiccatæ: *Frank S. Collins*; *Lemna Valdiviana*: *Walter Deane*; *Ulmaria Ulmaria*: *John Hendley Barnhart*; Rearrangement of the Columbia College Herbarium: *N. L. Britton*; A new *Ilysanthes*: *B. F. Bush* . . . 489

REVIEWS.—A Monograph of Lichens found in Britain; Flora of the outlying Carboniferous Basins of Southwestern Missouri . 492

PROCEEDINGS OF THE CLUB . . . 494

INDEX TO RECENT LITERATURE RELATING TO AMERICAN BOTANY . . . 497

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BULLETIN
OF THE
TORREY BOTANICAL CLUB.

Vol. 21. Lancaster, Pa., November 24, 1894. No. 11.

Wing-like Appendages on the Petioles of Liriophyllum populoides Lesq. and Liriodendron alatum Newb., with Description of the Latter.

By Arthur Hollick.

(Plates 220 and 221.)

The specimens upon which this paper is based were recently found while re-arranging some material in the geological museum of Columbia College. One of them had been recognized by the late Professor J. S. Newberry as a new species, and upon the specimen of *Liriodendron* he had attached the manuscript name which is here retained. The *Liriophyllum* was merely labeled under its generic name. The reason for not having named it specifically will be apparent when the discussion in regard to it is reached. I have brought them together in this paper for the reason that, although representing different geologic horizons in the Cretaceous formation, they are biologically closely related, and also because we have in these two species the first record in either genus of the peculiar appendages to the petioles to which I wish to call particular attention.

Liriodendron alatum Newb. mss.

(Plate 220.)

Leaves 4–5 inches long by 3–4 inches wide, oblong or ovoid in outline, rounded or somewhat cordate at base; deeply emarginate at apex, lobed or constricted at sides, or merely with wavy margins; petioles long, stout and conspicuously winged; nervation characteristic of the genus, consisting of two sets of parallel secondaries, one strong, connecting near the margins in festoons, the other weaker and intermediate with the former.

Laramie group, Walsenberg, Colo. Collected by Mr. J. Milligan under the direction of Mr. R. C. Hills.

The genus *Liriodendron* is represented in our living flora by a single species, *L. Tulipifera* L., our well known tulip tree, and a doubtful variety, *L. Tulipifera Chinense* Hemsl. from eastern Asia.*

In the past, however, ranging from middle Cretaceous through the Tertiary, we find a great number of species referable to the genus and its immediate ancestors, the leaves of which indicate diversities in form equal to those of the oaks of to-day and with a geographic range equally extensive.

An enumeration of all the described forms is not necessary here, as several papers upon the subject have been already written, prominent among which may be mentioned those by Dr. J. S. Newberry† and Mr. Theo. Holm.‡ Incidental comments may also be found in the works of Heer, Massalongo, Lesquereux, Ward and others.

If we examine the fossil species described under or referred to the genus we find the evolution of the leaf form to be exceedingly interesting and significant. The earliest ones (*Liriodendropsis simplex* Newb. mss., *Phyllites obcordatus* Heer, etc.) have little more than the characteristic emarginate apex by which to identify them with the genus. Others are slightly lobed or merely constricted at the sides (*L. primævum* Newb., *L. Meekii* Heer, etc.). Yet others are conspicuously lobed (*L. giganteum* Lesq., *L. acuminatum* Lesq., etc.), while the Tertiary species (*L. Procaccinii* Ung., *L. Helveticum* Fisch., etc.) are hardly to be distinguished from the living one. Attention may also be called, incidentally, to the fact that there was a constant increase in the size of the leaves during the period of greatest development of the genus, in cretaceous times. The particular species with which this paper has to do is of importance for the reason that only one other *Liriodendron*, and that an imperfect specimen, has been described from the Laramie group (*L. Laramiensis* Ward, Bull. No. 37, U. S. Geol. Surv. 102, *pl. 48, f. 2*), and also because our species possesses the unique characteristic of a winged petiole. Leaving this feature to be discussed further on, attention is now called to the significance of the leaf forms.

---

*1. "Description of some new Phanerogamia collected by Dr. Shearer, at Kiukiang, China," S. Le M. Moore, Journ Bot. 13: 225 (1875).

2. "Enumeration of all the plants known from China proper, Formosa, Hainan, Corea, etc." F. B. Forbes and W. B. Hemsley, Journ. Linn. Soc. 23: 25 (1886).

† "The Ancestors of the Tulip-Tree," Bull. Torr. Club, 14: 1–7. *pl. 61, 62* (1887).

‡ "Notes on the Leaves of *Liriodendron*," Proc. U. S. Nat. Mus. 13: 15–35. *pl. 4–9* (1890).

From the standpoint of the evolutionist the development of the individual is the epitome of the development of the type, so that we ought to find some traces of the ancestry of the genus in the successive leaf development of our living tulip tree. This aspect of the subject has been commented upon by several of the authors previously mentioned, but their works were prepared previous to the issue of Lesquereux's posthumous "Flora of the Dakota Group" (Monog. No. 17, U. S. Geol. Surv., 1892), and the great development of the genus there brought out was not known to the writers; neither, of course, was the species which is described in this paper, so that many points of significance were missed by them.

During the present year I made a series of observations upon and collected a number of specimens of leaves from seedlings, saplings, shoots from old stumps, and the branches of mature trees. They, of course, vary exceedingly, but by regarding the series as a whole it will be seen that there is a most striking parallelism between the entire or merely undulate margins of the leaves from the seedlings and young shoots and the earliest fossil forms, represented by *L. simplex*, *L. primævum*, etc., while it is in the leaves of the more mature branches that the lobing becomes of sufficient prominence to compare them with later forms like *L. giganteum*, *L. acuminatum*, etc.

The significance of the wing-like appendages to the petiole may now be considered. Similar appendages have been noted in other genera, and we are indebted to Prof. Lester F. Ward for having presented the case of *Platanus* ("Palæontologic History of the Genus *Platanus*," Proc. U. S. Nat. Mus. **11**: 39–42, *pl. 17–22*; "Origin of the Plane-Trees," Am. Nat. **24**: 797–810, *pl. 28*), and for showing that these appendages apparently represent former basilar lobes of the leaf, which have become detached and gradually crowded down the petiole until they finally exist as mere stipules at the bases of the petioles or on the branches adjacent. The living *Platanus occidentalis* L. often bears leaves on its young shoots which show basilar expansions similar to fossil ancestral forms, and the conspicuous foliaceous stipules at the bases of the petioles are familiar objects to us all. It seems reasonable, therefore, to attribute a similar origin to the conspicuous but fugacious stipules on the young saplings and shoots of *Liriodendron Tulipifera*, and this view is of course greatly strengthened by the discovery of the fossil species now under consideration. It is also of significance to note that the appendages to the petiole, as represented for the first time in *L. alatum*, made their appearance in the genus during the Laramie period, a time intermediate between the era of greatest lobation of the leaves in the middle Cretaceous and that of the development of a modern type in the Tertiary, in which the former excessive lobation has become greatly modified. This consideration of the subject logically leads to a discussion of the origin and significance of stipules in general, and raises the question whether they may all have had a similar origin. Such a question can not be decided, or even discussed at any length, until more data than are now in our possession have been accumulated, and the facts examined from the standpoint here indicated.

LIRIOPHYLLUM Lesq.

The genus *Liriophyllum* was founded by Lesquereux (Hayden's Rept. U. S. Geol. & Geog. Surv. 1876, 482) to include certain leaves evidently closely allied to *Liriodendron*. Under it he subsequently described three species of leaves and one fruit.*

A comparison of these leaves with the specimen now before us will at once show that the latter is apparently identical with *L. populoides*, which supposition is supported by the fact that they were both found in the same geological horizon (Dakota group) near Morrison, Colorado. The one difference between them is the winged petiole which is such a prominent characteristic in our specimen. Its absence in Lesquereux' specimens is doubtless to be accounted for by the imperfection of his material, but a close examination of his *fig. 2* will show that there is a widening of the petiole where it is broken off, which evidently indicates the existence of similar appendages.

---

* *L. Beckwithii* Lesq. Cret. and Tert. Fl. (1883) 76. *pl. 10, f. 1.*

L. populoides Lesq. l. c. 76. *pl. 11, f. 1, 2.*

L. obcordatum Lesq. l. c. 77.

Carpites liriophylli ? Lesq. l. c. 77. *pl. 11. f. 5.*

L. obcordatum was not figured at the time of its original description, but it may be found in Lesquereux' "Posthumous Flora of the Dakota Group" (Monog. 17: U. S. Geol. Surv. (1892) 210. *pl. 28, f. 7*).

Finally I would call attention to a point which may have considerable significance in relation to the theory of the origin of stipules previously outlined. The specimens which are the subject of our illustration apparently represent a large mature leaf and a smaller immature one. In the mature leaf there is a distance of about three-eighths of an inch between the base of the leaf blade and the beginning of the winged appendages, while in the young leaf they are in juxtaposition, conditions which are to be expected if our theory of their origin is the correct one.

NOTE.—Since writing the above Dr. Britton has called my attention to the following, which is of peculiar significance in this connection:

The late Dr. Thomas Morong, in his manuscript of "The Smilaceæ of North and Central America," in speaking of the species which climb by means of tendrils growing from stipular wings on each side of the petiole, uses these words in a foot note: "De Candolle regards this appendage as more in the nature of a modified leaf segment or leaflet than a stipule, but it seems to me that a stipule is nothing else than a leaflet at the base of a petiole."*

Two Species of Oxalis.

BY JOHN K. SMALL.

(PLATES 222 AND 223.)

For several seasons during my excursions through portions of the Southern States I have met with a peculiar little *Oxalis*, which became more and more interesting, as it was discovered at new and widely separated localities. For some reason every time I encountered the plant it suggested to me the name *Oxalis recurva*. After Elliott published that species* it received little recognition in the works of later botanists, and by them was generally recorded in an arbitrary manner as being identical with *O. stricta* or ignored altogether. When Dr. Trelease revised the genus in 1888† he attempted to reestablish Elliott's *O. recurva*, but, not having access to the type specimen, he went widely astray of the mark and applied Elliott's name to a very different plant. Dr. Trelease was apparently a little too unmindful of the laws of geographical distribution in concluding, especially without having seen the original specimen, that *O. recurva*, discovered on the coast of South Carolina, was a typically Middle States species.‡

---

* See Bull. Torr. Club, **21**: 419.

As recorded in the MEMOIRS of the Torrey Botanical Club, **2**: 44, Dr. Britton and party found what was then supposed to be *Oxalis recurva* at Roanoke and Eggleston's, Virginia. The following year (1891) Mr. Heller and myself, while passing through Roanoke, picked up some small specimens along the south bank of the Roanoke River, and pronounced them *Oxalis recurva*, on account of the strongly recurved pedicels; but on learning what was then known as that species, and being unable at that time to learn the cause of an evident confusion, the specimens were distributed as *Oxalis stricta*. Besides this locality, we also found similar plants a few days later near Gold Hill, in middle North Carolina. Little more was thought about the matter until the same plant turned up again further to the southwest, at the Falls of the Holston River, in Smyth county, Virginia, during the expedition of the Torrey Botanical Club to that region in 1892. In the report on that excursion § the plant was reluctantly placed under *O. stricta*, and the supposed *O. recurva*, found further up the same river, recorded as such. In the spring of 1893, while collecting in company with Dr. Britton about the Great Dismal

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* Bot. S. C. & Ga. **1**: 526.

† Mem. Bost. Soc. Nat. Hist. **4**: 71–104.

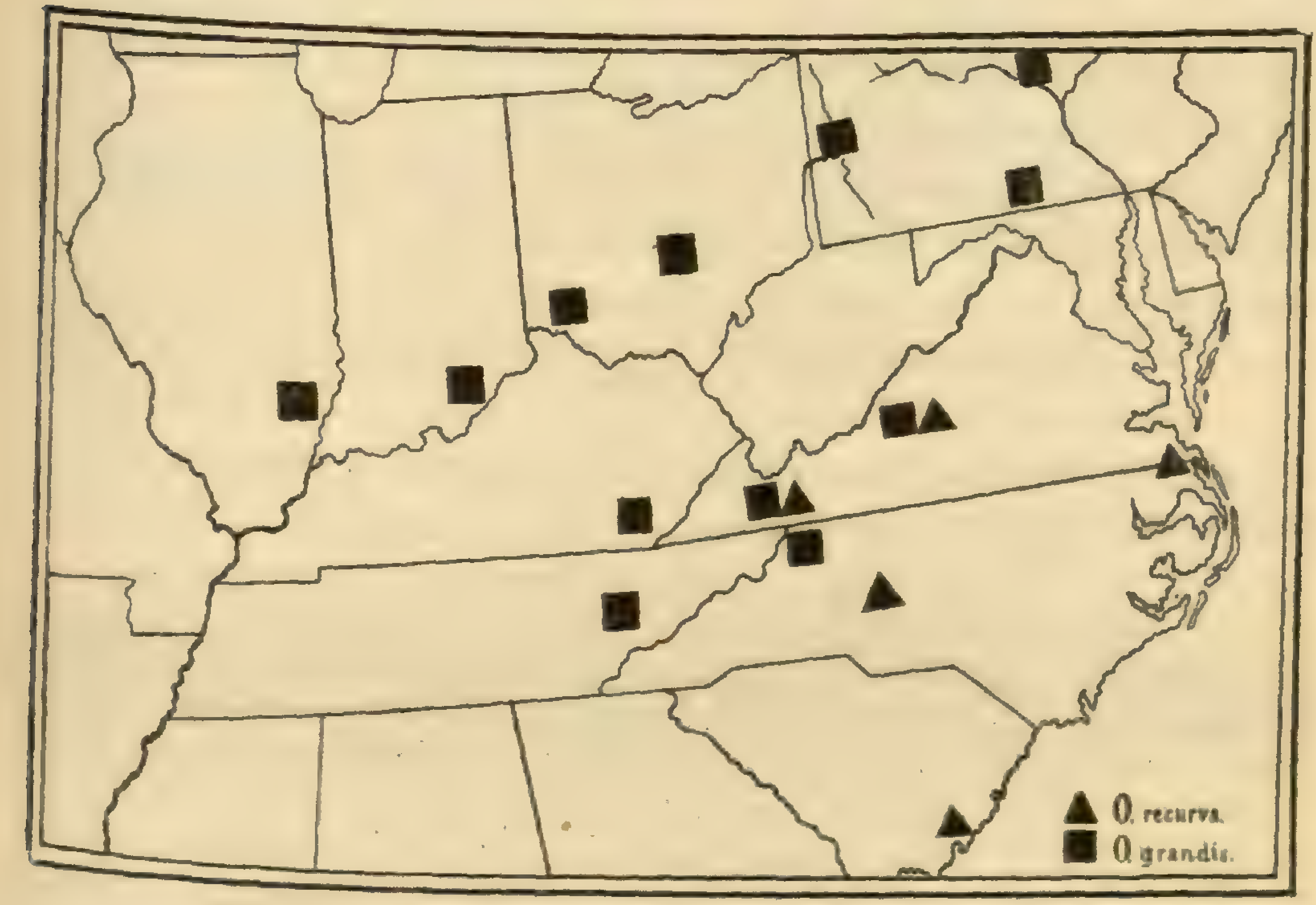
‡ Mem. Bost. Soc. Nat. Hist. **4**: 87.

§ Mem. Torr. Bot. Club, **4**: 109.

Swamp, the plant was found near North West, in southeastern Virginia.

Now with this geographical range to support a well-marked form the question arose: What is the plant? A new or a lost species?

While in Charleston last winter, I had an opportunity to examine the type of *Oxalis recurva* in Elliott's herbarium, at the Charleston College, and was not surprised to find that the small plant, which had been recently collected as cited above, was the same as Elliott's type. A comparative study of this form and the supposed *O. recurva* shows each to have, first, strong and constant morphological characters, which separate them from each other and related species, and second, a remarkably well-defined geographical range. A glance at the accompanying plates will convince any one of the specific validity of the two forms.



After dispensing with this part of the difficulty, a second question arose: What is the plant that has been passing for *O. recurva?* This form has been lying in herbaria, under one name or another, or unnamed, for many years. As far as I can discover, it appears to have been first found by Carey, at Wysox, Pennsylvania, in 1836, and then by Porter, at Mercersburg, in the same State, in 1850. During the last decade, especially the latter part, this plant, apparently rare, has become epidemic, being found successively at Mt. Carmel, Ill.; Hanover, Ind.; Cincinnati, Ohio; Roanoke and Eggelston's, Va.; Wall, Pa.; Franklin Co., Ohio; Marion, Va.; Knoxville, Tenn.; the Cumberland Mountains, Ky., and Caldwell Co., N. C. I have searched carefully through the books containing references to the genus *Oxalis* and compared descriptions and plates. Nothing in them seems to correspond to the plant in question, and, as far as I can learn, it never has received a name except that given to it erroneously. *Oxalis grandis* is a name that will serve to designate its size and the stately habit it assumes in growing.

The two species are so very dissimilar that no detailed account of their respective characters is necessary, but descriptions and plates are added, which will serve to show the great contrasts between them. As mentioned above, the geographical ranges are remarkably well defined, and a map is also given, on which the stations and ranges are plotted as they are now known. The range of *O. recurva* lies mainly to the east of the Allegheny Mountains, while that of *O. grandis* is for the most part west. The two ranges meet on the mountains at the Roanoke and Marion stations in Virginia. At present, then, we have two beautifully contrasted geographical areas for the two species under consideration, but as exploration goes on, in and about the mountains, we may expect to find more or less over-lapping of the two ranges.

OXALIS RECURVA Ell. Bot. S. C. & Ga. 1 : 526 (1821).

Annual or perennial by a very slender rootstock or wiry stolons, slender, sparsely pubescent, dark or purplish green. Stem erect, 1–2 dm. long, wiry, mostly simple, leafy throughout; leaves small, .5–1.5 cm. broad; leaflets obcordate, as long as broad or longer than broad, sometimes acuminate at the bases, nearly glabrous or sparsely pubescent, sinus deep, acute; petioles 3–4.5 cm. long; inflorescence umbellate; pedicels 2–4, much recurved in fruit, 1–1.5 cm. long, usually glabrous; peduncles 5–7 cm. long; calyx 4 mm. long, parted to near the base, segments oblong-lanceolote, obtuse, with a tuft of trichomes at the apex; corolla deep yellow, 7 mm. long, petals emarginate; styles pubescent with appressed hairs; stigmas entire; pod slightly curved, 8–12 mm. long, more or less pubescent; seeds oblong or ovoid, 1 mm. long, obtuse, brown, marked with continuous, transverse ridges (Plate 222).

Geographical and altitudinal range: Charleston, S. Carolina, at sea-level (Elliott); North West, Virginia, at sea-level (Britton & Small); Roanoke, Virginia, altitude 1000 feet (Small & Heller); Falls of the Holston River, southwest Virginia, altitude 2000 feet (Small); Gold Hill, North Carolina, altitude 200 feet (Small & Heller).

OXALIS GRANDIS n. sp.

Oxalis recurva Trelease, Mem. Bost. Soc. Nat. Hist. **4**: 89 (1888), not Ell.

Annual or perennial by a slender rootstock, rather stout, nearly glabrous or villous throughout, pale or light green. Stem erect, 2–4 dm. long, simple or sometimes sparingly branched, leafy above, soon naked below; leaves large, 4–7.5 cm. broad; leaflets usually unequal, obcordate, broader than long, mostly with a brown margin, more or less ciliate, sinus shallow but acute; petioles 4–12 cm. long; inflorescence subcymose or cymose; pedicels 1–1.5 cm. long, straight in fruit, pubescent, bearing one or two pairs of bracts; peduncles 8–13 cm. long; calyx 4–6 mm. long, parted to the base, segments unequal, ovate or linear-oblong, pubescent about the apex, sometimes sparsely ciliate and revolute; corolla bright yellow, 12–15 mm. long; petals 3–5 times as long as the sepals, not emarginate, with dark striæ about the centre or near the base; stamens persistent; styles very pubescent with spreading hairs; stigmas entire; pod narrowly-ovoid or oblong, acute, 8–10 mm. long; seeds 2 mm. long, rather unsymmetrical, oblong, acute, marked with interrupted transverse ridges and two conspicuous longitudinal ridges or crests on the back. (Plate 223.)

Geographical and altitudinal range: Wysox, Pennsylvania, altitude 700 feet (Carey); Wall, Pennsylvania, altitude 800 feet (Seal); Franklin county, Ohio, altitude 750 feet (Werner); Cincinnati, Ohio, altitude 500 feet (Lloyd); Hanover, Indiana, altitude 1000 feet (Barnes); Mt. Carmel, Illinois, altitude 450 feet (Schneck); Knoxville, Tennessee, altitude 1000 feet (Kearney); Caldwell county, North Carolina, altitude 2500 feet (Heller); Roanoke, Virginia, altitude 1000 feet (Britton); Marion, Virginia, altitude 2100 feet (Miss Vail); Cumberland Mountains, southeastern Kentucky, altitude 1000–2000 feet (Kearney); Mercersburg, Pennsylvania, altitude 750 feet (Porter).

Notes on some of the rarer Species of Polygonum.

By John K. Small.

(Plate 224.)

Some observations on the specimens of *Polygonum*, in the Herbaria of Prof. T. C. Porter, at Lafayette College, Mr. E. P. Bicknell and the Academy of Natural Sciences at Philadelphia, as well as the Herbarium of Columbia College, lead to the recording of some notes on the rarer species. These I have thought best to arrange and print in the following form, in advance of the publication of my monograph on the North American species of the genus.

Polygonum Newberryi Small, Bull. Torr. Club, **21**: 170 (1894).

The following Western collections should be referred to *P. Newberryi*: E. Hall, No. 446, collected in 1871; T. J. Howell, Mt. Hood (6,000–8,000 ft.), collected in August, 1881; E. C. Smith, No. 747, Mt. Ranier, Washington, collected August, 1890.

It may be interesting to note in this connection that glabrous forms of the above are related to *P. Davisiæ* of California, while the tomentose plants approach *P. sericeum*, of Siberia, in aspect.

Polygonum emersum (Michx.) Britton, Trans. N. Y. Acad. Sci. **8**: 73 (1889).

Polygonum rigidulum Sheld. Bull. Geol. and Nat. Hist. Surv. Minn. 9: 14. *t. 1* (1894).

Mr. Sheldon has evidently been misled, in describing a form or state of *P. emersum* under the name *P. rigidulum*, by not being sufficiently acquainted with the former plant. I have examined between one and two hundred specimens of *P. emersum* from all parts of North America, and cannot see that the characters assigned to *P. rigidulum* have any specific value. His distinguishing points are "larger size, aquatic habitat, the geniculate, branching, tumid stems and the obcuneate, almost glabrous, obliquely attached leaves." In the first place, *P. emersum*, like the other two members of the same group, *P. amphibium* and *P. Hartwrightii*, is very variable, although an exceedingly good species, and secondly, about one-half of the specimens I have examined possess all or some of the characters assigned by Mr. Sheldon to the proposed species, and the others show them in a greater or less degree.

After some years of observation on this and other species of *Polygonum*, I would not place much value in size, for some of our common species under certain conditions grow but two or three inches tall, while again we find them elongating to six feet. As to the aquatic habitats, at all the localities where I have met with *P. emersum*, I have found it ranging from almost dry ground to one or two feet of water, both in swamps, quiet margins of lakes and rivers and in fairly swift running currents. The amount and manner of branching, as well as the tumidity of the internodes, depends on the size and strength of the plants. The shape of the leaves and the amount of pubescence are of little or no value, for the same patches produce variously shaped leaves as well as a great variation in the length of the petioles, and some plants may be glabrous while others are entirely covered with strigose pubescence.

The specimens distributed from the collections of the University of Minnesota as *P. emersum* differ more from the usual state of that species than do the ones sent out as *P. rigidulum*, and I have seen but one other specimen that corresponds with them. This was collected in Scott's Bluff county, Nebraska, by Rydberg, No. 349.

POLYGONUM PUNCTATUM ROBUSTIOR n var.

Robust, of a rather dull green color, nearly glabrous. Stem erect, 4–7 dm. long, often with a long, creeping or horizontal base, more or less papillose, sometimes strigillose, leaves oblong or lanceolate, 3–17 cm. long, .5–4 cm. broad, paler on the lower surface than on the upper and strongly punctate, often crisped and undulate; ocreæ 1–1.5 cm. long, strigillose, fringed with long bristles, loose, mostly inflated about the nodes, sometimes opened obliquely at branching nodes; ocreolæ contiguous or imbricated entire, nearly naked; pedicels 3–4 mm. long; achene triquetrous, 3 mm. long, broadly-oblong, minutely granular but rather shining.

This variety is of aquatic habit, being characteristic of the borders of lakes, ponds and rivers. The creeping or horizontal bases often reach a length of three feet. The plants range from two to three times larger than the typical form and are showy on account of the large white flowers which are about 6 mm. in diameter. The achene, besides being larger than in the normal form, is more distinctly granular and often rather dull, and I have found no lenticular ones on the plants at hand.

It ranges southward through the Atlantic States from Massachusetts, and occurs also in Mexico, Central and South America.

POLYGONUM LONGISTYLUM Small, Bull. Torr. Club, **21**: 169 (1894).

Since describing the above species I have seen specimens from New Madrid Co., Missouri (Bush, No. 177); New Orleans, Louisiana (Ingalls); Alexandria, Louisiana (Hale); Indian Territory (Palmer, No. 286).

POLYGONUM MEXICANUM Small, Bull. Torr. Club, **19**: 356 (1892).

In 1883 *P. Mexicanum* was gathered as far south as Camaron, Mexico, by J. N. Rovirosa.

POLYGONUM OPELOUSANUM Riddell; Small, Bull. Torr. Club, **19**: 354 (1892).

Since the writing of my last note concerning the above species* it has been found in Newton county, Missouri, by Mr. B. F. Bush in September, 1893. He records it as growing in swampy places and as being uncommon, and distributed it as *P. acre leptostachyum* (321), which form, however, it does not resemble. The plant is thus brought within the limits of our conventional Northern Flora, and, like various other Southern species, it follows the Mississippi River Valley as far north as the swamps of southeastern Missouri. The specimens of this collection are very much like the type, both in their external appearance as in the very slender build, the strict and erect branches and the numerous and linear leaves, and in the minute characters of the achene, the flowers and the strongly and conspicuously fringed ocreolæ.

POLYGONUM SETACEUM Baldw.; Ell. Bot. S. C. & Ga. **1**: 455 (1817).

Heretofore confined to the Southern States, this form has lately been collected at three different stations within the bounds of the Northern Flora. Mr. Bush made two collections (114, 118) of it in Dunklin county, Missouri, in September, 1893. In the same month and year Mr. H. Eggert found the plant in Butler county, southeastern Missouri, growing in the swamps of that region. This, like the preceding, follows the Mississippi River northward, and also shows the same variation in the amount and strength of the strigose pubescence as do the Southern individuals of this species.

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* Bull. Torr. Club, **21**: 168.

POLYGONUM PERSICARIOIDES H.B.K. Nov. Gen. **2**: 179 (1817).

This species has been found within the limit of the Northern Flora by Mr. H. J. Webber on the Dismal River, Nebraska. The specimens of the collection are not numbered, but are dated July 14, 1889.

POLYGONUM CAREYI Olney, Proc. Prov. Franklin Soc. **1**: 29 (1847).

There is an unnamed specimen of the above, lying in the Herbarium of the Academy of Natural Science at Philadelphia, collected by Dr. Pitcher at Fort Gratiot, Michigan. No date is given, but the specimen was evidently found a number of years before the originals of Olney were collected.

POLYGONUM BOREALE (Lange).

Polygonum aviculare L. var. *boreale* Lange, Consp. Fl. Grœnl. 105 (1880).

Annual, glabrous, herbaceous and somewhat fleshy. Stem ascending 1–2 dm. long, simple or sparingly branched; leaves obovate, oblong or elliptic-obovate, 1–3 cm. long, .5–1 cm. broad, obtuse, slightly papillose, somewhat acuminate at the base, short-petioled, mid-rib alone prominent; ocreæ oblique 5–7 mm. long, silvery or brownish, only slightly lacerate; axillary clusters 2–5 flowered; pedicels slender; 3–4 mm. long, 5-parted to below the middle, calyx 4 mm. long, segments obtuse, light green, with white or cream-colored borders inclined to be open; stamens 6, included; filaments short and stout; style 1 mm. long, 3-parted to the base; achene ovoid, 3.5 mm. long, triquetrous, somewhat pointed, dull and striate-reticulated. (Plate 224.)

I have now seen this form from two Greenland collections and can not find any characters that warrant its disposal as a variety of *P. aviculare*.

The general character of the plant is different from that species, and the diagnosis as given above will serve to separate it. One of the best distinctions is in the fruit. *P. aviculare* has a pyramidal-ovoid achene, whereas that of *P. boreale* is simply ovoid and twice as large. We have the plant from two stations in Greenland, Fgaliko (Rosenvinge) and Christianshål (A Hartz) July, 1890.

Since writing the above a sheet from the Meisner Herbarium has been seen which bears a specimen of the above collected in Iceland by Mr. Ed. Jardin in 1866, and on the label Meisner has written a name which, however, like a number of other manuscript names, he never published.

POLYGONUM RAMOSISSIMUM PROLIFICUM Small, Bull. Torr. Club, **21**: 171 (1894).

I described this variety with some hesitation from specimens from a single locality in Nebraska. Since then the same form has been found by Prof. A. S. Hitchcock, at Olathe, Kansas, and by Mr. E. P. Bicknell, at York Harbor, Maine. These collections, although smaller than the type, are otherwise almost identical.

POLYGONUM EXSERTUM Small, Bull. Torr. Club, **21** : 172 (1894).

Collections have recently been made extending the range of this lately described species. They are as follows: Numerous stations within the influence of brackish water north of New York city (Bicknell); Woodbridge, New Jersey (Lighthipe); Atchinson, Nebraska (Bush); distributed as *P. ramosissimum*, number 329 and Saskatchawan (Bourgeau). The latter is an old collection made in Paliser's British North American Exploring Expedition, during 1857–8, distributed as *P. aviculare* var., and placed provisionally by me under *P. ramosissimum* in my Preliminary List of American Species of Polygonum.

POLYGONUM SAWATCHENSE Small, Bull. Torr. Club, **20**: 213 (1893).

Plants almost identical with the type of *P. Sawatchense* are preserved in the Herbarium of Lafayette College. They were collected in the mountains near Bridger Butte, Wyoming, on July 7, 1873, by Prof. T. C. Porter, and represent the fleshy, reduced and scurfy state this species assumes at high altitudes. The more elongated and wiry form has also been found in 1892, at Custer, in the Black Hills of South Dakota, by Mr. P. A. Rydberg (No. 983).

POLYGONUM TENUE Michx. Fl. Bor. Am. **1**: 238 (1803).

Polygonum microspermum Sheld. Bull. Geol. and Nat. Hist. Surv. No. 9, 70 (1894), not Small.

Polygonum tenue var. *microspermum* Sheld. l. c., not Engelm.
Polygonum Engelmanni Sheld. l. c., not Greene.

Specimens of *P. tenue* from Minnesota have lately been erroneously referred to *P. microspermum*,* and to avoid further confusion of the geographical range of the latter species, I take this means of correcting the mistake. Taking into consideration the fact that *P. microspermum* is a characteristic plant of the highest mountains of Middle Colorado, where it has been collected only two or three times and at stations not widely separated, and then taking into consideration the laws of geographical and altitudinal distribution, we should not expect to find the species at a comparatively low altitude in Minnesota. Further, an examination of the specimens on which Mr. Sheldon based his determinations shows them to lack all the essential characters of *P. microspermum*, and to possess all the essential characters of *P. tenue*. Selecting a few of the more prominent characters, we see that *P. microspermum*, like *P. Douglasii*, has a flat leaf. *P. tenue* has leaves with two lateral impressions on either side of and parallel with the midrib. They also differ much in shape from those of *P. microspermum*. The pedicels of the latter species are slender and deflexed, even in flower, whilst those of the former are short (sometimes almost wanting), stout and always erect. The achene of *P. microspermum* is oblong or oblong-ovoid, smooth and shining; that of *P. tenue* is strictly ovoid, granular on and about the angles, smooth and shining only at the centres of the faces. The Minnesota specimens referred to, collected in Chippewa county, possess all these characters of *P. tenue*, and others, into whose details it is unnecessary to enter, as the manner of branching, the texture, flowers, ocreæ, etc.

POLYGONUM CRISTATUM Engelm. & Gray, Bost. Journ. Nat. Hist. **5**: 259 (1847).

Only three stations for this rare and interesting species were known up to this season. Two of these were about Aiken, South Carolina, while the original was in Texas. While collecting in Middle Georgia this season I met with the plant, first at various points on the slopes of Stone Mountain, and subsequently encountered it in the Yellow River Valley and about Logansville. This discovery was not a surprise, as this region is between the former known localities. However, several days ago, Mr. Bicknell placed his collections of *Polygonum* for the past season at my disposal, and to my great surprise I find that he has secured *P. cristatum* from two stations in the Moshaloo Woods, near Riverdale, New York.

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* Bull. Geol. and Nat. Hist. Surv. Minn. 9: 70.

POLYGONUM CUSPIDATUM Sieb. & Zucc. Pl. Japon. Fam. Nat. 2: 84 (1846).

This Japanese species is gradually establishing itself in our Eastern States. It has become naturalized about Philadelphia, Pa., and Schenectady, N. Y., and during the present season Mr. T. H. Kearney, Jr., has found it established at Atlantic Highlands, New Jersey.

Three species, *Polygonum polycenemoides*, *P. setosum* and *P. equisetiforme*, natives of Eastern Europe, Western Asia and Northern Africa, have been found established by Mr. Bicknell, in the ruins of the Yonkers Carpet Mill. The fruit has been introduced from the above cited region in wool which was used at the mill. These species are the kind that take a firm hold in such situations as they are now growing in at Yonkers, whence they may spread and eventually become naturalized.

Some new Florida Plants.

BY T. H. KEARNEY, JR.

SCUTELLARIA INTEGRIFOLIA MULTIGLANDULOSA n. var.

Differs from typical *S. integrifolia L.* in the shorter stems with longer, more spreading and more glandular pubescence, in the obovate or oblanceolate upper leaves, which are less diminished and bract-like above, so that the inflorescence has a less racemose character, in the longer and more glandular pedicels, in the more glandular calyx and in the larger lower lip of the shorter, more ringent corolla.

Collected by Dr. Boykin in "the low country of Georgia;" by Chapman in Florida; by Rugel in 1843 near St. Mark's, in the same State, and by Mr. George V. Nash in 1894 near Eustis.

TRICHOSTEMA SUFFRUTESCENS n. sp. Root stout, ligneous; stem woody at base, erect 2.5–5 dm. high, branching from near the base, very leafy, canescent, densely glandular-puberulent towards the summit; leaves opposite with smaller ones fascicled in the axils, short-petioled, blade 1 cm. long and about one-half as wide, the uppermost much reduced and bract-like, oblong-ovate or obovate, wedge-shaped at base, rounded and sometimes slightly emarginate at apex, thickish, obscurely punctate, margin ciliate, both surfaces minutely glandular-puberulent; veins, except the midrib, obscure; flowers on slender, recurved, glandular pedicels in panicled, one-sided racemes; calyx strongly oblique, slightly puberulent and covered with shining glandular grains, bright green, veins conspicuously reticulated, upper three teeth about twice longer than the two lower ones, all acute; corolla strongly bilabiate, bright blue; filaments 20–25 mm. long, closely coiled; nutlets gray-brown, obovoid, about 1.5 mm. in longest diameter, rugose-reticulated, reticulations small and shallow.

Nearest to *T. dichotomum* L., from which our plant differs in the woody base of its stem, in the shorter-petioled and smaller leaves, in the finer and more glandular pubescence of stem and calyx, in the much longer filaments (10–15 mm. long in *T. dichotomum*) and in the smaller and darker nutlets, which are less deeply reticulated, with smaller and rounder areolæ. Resembles in habit *T. Arizonicum* A. Gray, but the irregular corolla places it in Section *Streptopodium* Benth.

Collected at Eustis, in 1894, by Mr. George V. Nash (Number 625).

PLUCHEA FŒTIDA IMBRICATA n. var. Perennial from a stout, somewhat woody rootstock; stem herbaceous, erect, 8–24 dm. high, branched towards the summit, angled, striate, cinerous-pubescent, also resinose-granular above; leaves thick, firm, dull green, lower 5–6 cm. long, 2–2.5 cm. wide, upper much reduced, clasping by the short auriculate base, ovate-oblong to triangular-ovate, broadest at base, mucronate at apex, coarsely and unevenly dentate-serrate with rigid callous teeth, upper surface glandular-puberulent, lower surface more densely so, veins reddish-brown, prominent on the under surface; heads 7–8 mm. high on short, stout, pubescent peduncles, in dense, cymose, rounded clusters which are subtended by two to four small, bract-like leaves and are borne at the summit of short or sometimes greatly elongated branches from the axils of the upper leaves; involucral scales reddish brown, glandular-puberulent, imbricated in 4–6 rows, the outermost short, ovate-oblong, rounded at summit, the innermost much longer, linear-lanceolate, subulate-acuminate; flowers rose-colored, the hermaphrodite few or many in the centre of the head, the corolla resinose-granular towards the throat; anther tips exserted; achenes hispidulous.

Differs from typical *Pluchea fœtida* (L) B. S. P., in the following particulars. The stem is usually taller and stouter. The leaves are thicker and firmer, broader at base, the uppermost triangular-ovate. The axillary branches on which the clusters of heads are borne are usually very short, giving the whole inflorescence a racemose appearance, but are sometimes elongated as in ordinary *P. fœtida*. The clusters are very dense, the peduncles of the heads being short. The heads are somewhat larger and the involucre much more imbricated. The scales are deeper colored and more pubescent, the outer shorter, broader and more rounded.

Collected at St. Mark's, Florida by Rugel in 1843, and by Mr. George V. Nash (No. 1434) near Eustis, Florida, in 1894. Grows at the margins of lakes in grassy, swampy ground. Flowers in July and August. May prove to be a distinct species.

Teucrium Nashii n. sp. Perennial, herbaceous; stem 6–9 dm. high, erect, branching above, four-angled, deeply sulcate, canescent with a fine, appressed pubescence; leaves short-petioled, blade 4–10 cm. long, 1–3 cm. wide, oblong to ovate-lanceolate, acute at both ends, closely and evenly serrate, dark green and minutely appressed-pubescent above, densely white-tomentose beneath, veins prominent on the lower surface; calyx white-tomentose, three upper teeth short triangular-ovate, the middle one slightly longer, acute, the others rounded, two lower teeth considerably longer, triangular-lanceolate, rather abruptly subulate-acuminate to almost mucronate; corolla minutely glandular-puberulent; nutlets brown, reticulated, areolæ shallow.

Resembles *T. Canadense*, from which it differs in the finer pubescence of every part, in the darker green upper surface of the leaf, in the densely white-tomentose under surface, in the broader and more rounded upper teeth and the more abruptly pointed lower teeth of the white-tomentose calyx, and in the rather larger and less deeply reticulated nutlets.

Collected in middle Florida in 1836, by Dr. Chapman; in Duval county, Florida, by Mr. A. H. Curtiss (No. 1975), and near Eustis, Florida, in 1894, by Mr. George V. Nash (Numbers 1496, 1505 and 1516).

PHYSALIS ARENICOLA n. sp. Plant light green; stems 2–4 dm. high, erect from long slender* branching rootstocks, much branched, slender, striate, pubescent with simple hairs, some minute and usually glandular, others longer, two or three jointed and non-glandular, often glabrate with age; leaves in pairs, one usually smaller, petioled; petioles 1–3 cm. long, slender, puberulent; blade 1.5–6 cm. long, 1.5–4 cm. in greatest width, ovate or ovate-oblong, irregularly and not deeply undulate or angulate-dentate, obtuse at apex, truncate or subcordate and unequal at base, appressed-ciliate, upper surface puberulent on the veins, lower surface appressed-pubescent chiefly along the veins, veins rather conspicuously reticulated below; flowers axillary, on slender pubescent pedicels as long as or longer than the petioles; flowering calyx pubescent with both long and jointed and minute, simple, glandular hairs, 7–8 mm. long, teeth triangular, acute, nearly as long as the tube; corolla rotate-campanulate, about 15 mm. in diameter in the throat, minutely ciliate, light yellow with a brown-purple center; anthers yellow; fruiting calyx about 3 cm. high, rather narrowly pyramidal-ovate, teeth many times shorter than the tube, with margins often darker colored, conspicuously reticulate-veined, minutely pubescent on the veins and margins of the teeth; berry light yellow.

Physalis arenicola is most nearly allied to *P. Virginiana* Mill., but presents several well-marked characters which distinguish it from that species. The pubescence is much finer and less glandular. The stems are more slender. The leaves are smaller, more regular in outline, on more slender petioles, less deeply toothed, never acuminate, the upper surface nearly glabrous, the lower minutely pubescent, the pubescence mostly confined to the veins. The flowering calyx is much less hairy. The calyx in fruit is glabrous save on the veins and margins of the teeth. The corolla is quite glabrous, except for the ciliate margin. The whole plant is greener and more delicate in every way than *P. Virginiana.*

Collected in light sandy soil along railroad embankments near Eustis, Florida, in 1894, by Mr. George V. Nash (Numbers 154, 170, 1059, 1170). Flowers from March to July.

ARISTOLOCHIA NASHII n. sp. Root a cluster of long, slender fibres from a short knotty rootstock; stems 10–22 cm. long, single or two or three from the same rootstock, simple or sparingly branched, erect, slender, flexuous, rather sparingly pubescent with short, lax, white hairs, leafy above, upper internodes about equal in length, each departing from the next lower at an angle of about 45 degrees; petiole pubescent, 1–3 mm. long, standing at right angles to the internode above; blade of leaves thin, margin ciliate, upper surface dark green, lower surface somewhat paler, both sparingly appressed-pubescent, especially on the rather prominent veins, in the lowest leaves often short-ovate and cordate, in the upper 2–5.5 cm. long, 5–10 mm. in greatest width, linear to oblong-lanceolate, tapering from below the middle to the obtusish apex, base narrowly sagittate to deeply auriculate with both lobes equal or with one longer; peduncles one to four near the base of the stem, 1–3 cm. long, slender, villous-pubescent, especially towards the summit, bearing two to five minute, pubescent bracts, one-flowered; calyx pubescent, brown-purple, the tube 10–12 mm. long, the limb about 1 cm. in diameter, reticulate-veined; immature capsule villous, especially upon the ribs.

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* One plant out of about forty examined has the rootstock considerably thickened.

Allied to *A. Serpentaria* L., but easily distinguished by the narrow leaves and very short petioles. Collected at Lake Ella, Florida, in 1894, by Mr. George V. Nash (No. 1139).

✓ RHUS BLODGETTII n. sp. Stem leafy, angled, striate, pubescent towards the summit, bark reddish-brown; leaves petioled, trifoliolate; petioles striate, pubescent, 2.5–4 cm. long; leaflets 3–5 cm. long, 2.5–3 cm. wide, ovate or ovate-oblong, short-acuminate, base rounded or acutish, entire, thick, coriaceous, upper surface dark-green, smooth and shining, lower surface paler with tufts of tawny hairs in the axils of the principal veins and at the base of the midrib, elsewhere quite glabrous, terminal leaflet on a petiolule 1–2 cm. long, lateral almost sessile; flowers in small, axillary, thrice compound panicles; calyx persistent, very small, 5-lobed, lobes acute; fruit a yellowish-white, shining drupe, subglobose, tipped with the rather stout base of the style, 2.5 mm. in longest diameter; stone ash-colored, 10–12 striate, minutely roughened.

Apparently an erect shrub, flowers not seen. Closely allied to *Rhus radicans*. It may easily be distinguished by the smaller, short-acuminate but not acute, thick and coriaceous leaflets, the upper surface shining and perfectly smooth, the lower surface pubescent only in the axils of the veins and at the base of the midrib, the margins not ciliate; and by the fruit, about half as large as that of typical *R. radicans*.

Rhus radicans has the upper surface of the leaf almost always pubescent at least on the midrib, the lower surface pubescent all over and the margins ciliate. A peculiar form from Sonora, Mexico, collected by Schott, has the upper surface of the rather coriacious leaflets entirely glabrous, but differs in other respects from *R. Blodgettii*.

The single specimen which I have seen was collected by Blodgett, at Key West, Florida. It is in the Torrey Herbarium.

Two new Genera of Plants from Bolivia.

By H. H. Rusby.

(Plates 225 and 226.)

*LOPHOPAPPUS.

Nat. Ord. Compositæ, tribe Mutisiaceæ.

Flowers of the head about 8, all alike, perfect; involucre cylindrical to slightly campanulate, the bracts 4–5-serialed, imbricated, appressed, oblong, keeled and aristate, serrate, cartilaginous, the innermost oblanceolate, sub-hyaline, cuspidate, ciliate, faintly papillose without; receptacle small, concave, papillose; corolla 2-lipped, the lips recurved, the lower 3-toothed, the upper 2-parted; anther-base sagittate, the acute lobes adherent, or with very short free tips, the elongated terminal appendages obtuse; style-branches short, thick, slightly spreading, the apex rounded; akene oblong-linear, inequilateral, 4- or imperfectly 5-costate, hispid; setæ of the pappus barbellate, at the summit tufted. A much branched shrub, with alternate, crowded, aristate, entire, coriaceous leaves, and small heads sessile and solitary at the ends of the branchlets.

Endeavor has been made to include this plant in *Proustia*, but it differs too greatly in its habit, its solitary heads, cylindrical, few-serialed involucre with different scales, the obscure anther-tails, short style-branches, and barbellate and penicillate setæ of the pappus.

Lophopappus foliosus.

Branches slender, erect, dark gray-brown, strongly striate, the branchlets tuberculated by the persistent bases of the fallen leaves; leaves 7–12 mm. long, scarcely 1 mm. broad (in the dried, involute state) oblanceolate, sessile, sub-aristate and pungent, strongly 3-ribbed, involute, thick, rigid, finely canescent above, sparingly hirsute and muricate below; heads partly concealed in the crowded leaves, 10–12 mm. long, 6–8 mm. broad, the rich brown pappus slightly exceeding the involucre and about as much exceeded by the flowers; corolla white, 7.5 mm. long, divided to the middle; anthers 4–5 mm. long, including the appendages, which are 2 mm. long; style-branches scarcely 1 mm. long, nearly one-half as broad; akene 3 mm. long, .5 mm. broad. (Plate 225.)

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* I am indebted to my friend, Dr. Charles Rice, for the selection of this very expressive name.

Collected by Mr. Bang in the vicinity of La Paz, altitude about 10,000 feet, 1889 (No. 66), and at Talca Chuguiaguilla, April, 1890 (No. 791).

FLUCKIGERIA.

NAT. ORD. GESNERIACEÆ (SUBTRIBE COLUMNEÆ.)

Calyx free, deeply 5-fid, hirsute, the segments entire, lanceolate, somewhat rigid, erect or the apex spreading. Corolla hirsute, the tube nearly straight, infundibuliform with contracted mouth and equal limb, the lobes whitish on the inner face, cartilaginous-thickened, short, inflexed, broadly imbricated. Stamens inserted near the base, included, the filaments distinct, pilose, slightly flattened at the base, a slight vestige of the fifth present, the anthers short, the cells parallel. Disk of 5 glands with 4 intermediate papillæ, the two posterior glands slightly larger, united, the other three short-acuminate, slightly notched at the apex. Ovary superior, with the placentæ of the sub-tribe, style included, stigma terminal, small, 2-cleft. Fruit not seen. Genus dedicated to Prof. Dr. F. A. Fluckiger, of Berne, one of the distinguished authors of the Pharmacographia.

FLUCKIGERIA FRITSCHII. Herbaceous, stems elongated, erect, simple, bright red, obscurely angled, pilose, the internodes twice the length of the ternate leaves, which are sub-sessile, 3–5 cm. long, 1.5–2.5 cm. broad, oval-ovate, the base rounded, very abruptly contracted into a very short petiole-like base, apex short acuminate, coriaceous, revolute, pallid, appressed-hirsute, purple-veined, one pair of nerves forming the narrow purple margin; pedicels solitary, short and stout; calyx 1.5 cm. long, the lobes acuminate, densely hirsute both sides with purple tips; corolla bright purple, densely hirsute, 2.5 cm. long, the lobes 3 times as broad as long; stamens reaching a little beyond the middle of the corolla, the filaments yellow, pilose, the anther-cells broadly oblong; ovary ovate-conical, hirsute like the style, which is shorter than the corolla. (Plate 226.)

Collected by M. Bang, Yungas, 1890 (No. 401), species dedicated to Prof. Dr. Karl Fritsch, who has kindly confirmed my diagnosis.

EXPLANATION OF PLATES.

PLATE 223. *Lophopappus foliosus* Rusby.

(1) Flowering branch, (2) inner scale of involucre, (3) flowering head, (4) outer scale of involucre, (5) flower, (6) three anthers, (7) upper part of style.

PLATE 224. *Fluckigeria Fritschi* Rusby.

(1) Flowering stem, (2) disk × 2, (3) calyx with ovary, (4) mouth of corolla laid open, (5) base of corolla with stamens, (6) pistil.

Cryptogamic Notes from Long Island.--II.

BY SMITH ELY JELLIFFE.

HEPATICÆ.

Frullania Eboracensis Gottsche.
Frullania Asa-Grayana Mont.
Radula complanata (L.) Dumort.
Porella platyphylla Lindb.
Aneura Pinguis (L.) Dumort.
Trichocolea tomentella (Ehrh.) Dumort.
Scapania nemorosa (L.) Nees.
Plagiochila porelloides Lindenb.
Pellia epiphylla (L.) Nees.
Marchantia polymorpha L.
Conocephalus conicus (L.) Dumort.
Riccia fluitans L.
Riccia natans L.

BROOKLYN, Sept. 20, 1894.

Botanical Notes.

Pistillody. The note in the last BULLETIN regarding pistillody in the Mandrake called to mind a very similar case at Racine, Wis., this last spring. A student in studying the *Podophyllum* discovered a stamen which was normal in all particulars except that one-half of the anther bore a stigmatic lobe, the nature of which was easily recognized by its color and convolution, which exactly imitated those of a true stigma. *Podophyllum peltatum*, thus giving two cases in one spring in such widely separated places, may be justly regarded as being uncommonly susceptible to pistillody.

Staminody occurred freely on a birch tree (*Betula populifolia*), in the suburbs of Racine. The pistillate catkins bore stamens for a half inch or more from the end.

Teratology. Two items which seem worthy of record will be mentioned. A *Trillium grandiflorum* was found in which a stamen and a petal were united edge to edge, one anther cell being obliterated by the union. It did not seem to be a case of reversion, as only the normal number of petals were present. A *Rheum Rhaponticum* stamen was seen which bore on its apex the filament of another stamen. This second stamen was perfect, and, in every observable detail, like any other in the flower. This occurrence of stamens, "tandem," as it were, reminds one of the prolification of the rose, giving one peduncle from the centre of another flower, but any such phenomenon among stamens has never come to my notice before.

F. L. STEVENS.

SYRACUSE, N. Y., July 12, 1894.

Algæ Exsiccatæ. The undersigned have made preparations for the issuing of sets of dried specimens of the North American Algæ, both of the fresh and of the salt waters, for the aid of investigators and to assist in the development of a better knowledge of the North American species. Contributions of sets of 80 specimens each are solicited.

FRANK S. COLLINS,
WILLIAM A. SETCHELL,
ISAAC HOLDEN.

All interested are requested to address Frank S. Collins, 97 Dexter St., Malden, Mass.

Lemna Valdiviana Philippi. I have collected and floated out a large number of sheets of the *Lemna Valdiviana*, recently discovered by Dr. Geo. G. Kennedy in Randolph, Mass. As the station is an interesting one, the plant will be desired by botanists, and I shall be glad to send it to anybody who may ask for it.

WALTER DEANE.

9 BREWSTER STREET, CAMBRIDGE MASS., November, 1894.

Ulmaria Ulmaria (L.) (*Spiræa Ulmaria* L. Sp. Pl. 490 (1753). *Ulmaria palustris* Mœnch, Meth. 663 (1794).)

This plant was collected by me during the past summer at Trois Pistoles, in the province of Quebec. It was growing by a wire fence near the track of the Intercolonial Railway and was quite wild. There is a specimen of this species in the Herbarium of Columbia College, collected by W. M. Whitfield at Lenox, Mass., July 11, 1889. Who can furnish information of other American localities?

Curiously enough, the binomial used above appears not to have been published before. John Hendley Barnhart.

Tarrytown, N. Y., October 5, 1894.

The Columbia College Herbarium has within the last month been re-arranged, the families now following the sequence of Engler and Prantl's "Natürliche Pflazenfamilien;" the genera will gradually be placed in the sequence of that work as the volumes are completed. The advantages of this system are: (1) The indications it affords of the phylogeny of the groups. (2) The convenience of having the arrangement of the whole collection based on one set of volumes. The mechanical work of moving several hundred thousand mounted sheets appeared at first to be very considerable, and as the space available for stacking is limited, we delayed the work long after we had decided to undertake it, but it has really been accomplished with ease and rapidity, and we are confident that much has been gained. The "Natürliche Pflanzenfamilien," having appeared so very recently, contains many more genera of Spermatophyta than Bentham and Hooker's "Genera Plantarum," and a great many specimens which in some herbaria have been placed at the ends of the orders and in others interspersed through the generic sequence will now find their place in the series.

Of course no student will be willing to accept all the generic limitations of Dr. Engler's books any more than he was willing to accept all of Bentham and Hooker's, but the recent publication of the former gives it a distinct advantage. It is to be hoped that a generic index to the whole work will be printed.

N. L. Britton.

Reviews.

*A Monograph of Lichens.**—Probably the first thought that suggests itself to the student on perusing this book is, Why was it ever published? It certainly is to be regretted that any one should at this time make such efforts to darken a field of learning that is so much in need of light as lichenology. Part I. of the work has made its appearance. The author has attempted to classify the British Museum material. This in itself was certainly a commendable undertaking, nor can any very serious objections be raised against the system of classification adopted, which is essentially that of Nylander; but no one can now be excused for refusing to recognize the true nature of the lichen structure. The author recognizes the algæ of lichens as "gonidia" of older authors, and groups them into three kinds, "gonidia, gonidimia" and "gonimia." Gonidia are defined as "the green cells of the thallus;" gonidimia as "green cells smaller than gonidia and with the cell wall less distinct;" gonimia, "bluish-green naked granules."

One would naturally conclude that an English scholar would or could understand and use the English language, but such does not seem to be the case. To illustrate, I will cite a few more definitions, before criticising the general phraseology of the body of the work. "Applicate" is defined as "forming the thalline border in many crustaceous lichens." "Evanescent—Reduced to mere gonidia scattered over the substratum;" "Nuclear—Roundish with an apical pore." These definitions become somewhat intelligible after a careful reading of the text. The author's peculiar Latino-Anglo-phraseology was no doubt the result of a long continued study of Nylander's classical works on lichens. Here is a sample. Of *Collema leptogiella* he says: "Thallus effuse, thin, minutely subcoralloideo-furfuraceous, olive-brown, apothecia leptogioid, minute, lurid-testaceous, slightly margined, the epithecium somewhat impressed or at length subplane; spores ellipsoid or oblongoellipsoid, 0.010–17 mm. long, 0.005–7 mm. thick; paraphyses slender, or somewhat slender, thicker at the apices; hymenial gelatine tawny, wine-reddish with iodine." This certainly is a mixture and thus it continues through the entire book.

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* A Monograph of Lichens found in Britain: being a descriptive Catalogue of the species in the Herbarium of the British Museum, by the Rev. James M. Crombie, M. A., F. L. S., F. G. S., etc. London, 1894.

The figures are fairly good from an artistic point of view, but unfortunately various lichen structures are incorrectly named. The algæ are, of course, never rightly named. In *Nephromium lævigatum* he has evidently designated as "sterigmata" and "spermatia" the hyphal cells surrounding the algal groups.

There is one redeeming feature in the author's work, and that is the faithful application of chemical tests to, I believe, every species of lichen examined; and by this feature alone the work may perhaps live. The tests are simple and easy of application. They are essential to a more reliable method of determining species.

ALBERT SCHNEIDER.

COLUMBIA COLLEGE.

Flora of the outlying Carboniferous Basins of Southwestern Missouri. David White (Bull. 98, U. S. Geol. Surv. Pamph. pp. 139, *pl. 1–5*. Washington, 1893).

This flora is of special interest biologically in view of the fact that it must have grown at an altitude several hundred feet above the old marshes which now constitute the coal fields of northern Missouri and eastern Kansas. It represents essentially an upland flora as compared with that of the semi-inundated areas mentioned. It is particularly characterized by the presence of Neuropterid ferns and the leaves of *Cordaites*.

Neuropteris Jenneyi, N. caudata, Sphenopteris Lacoei and Pecopteris (*Asterotheca*) *Lesquereuxii* are described and figured as new species.

Each species described is accompanied by a complete synonomy and bibliography, arranged in chronological sequence, followed by critical notes on relationship, etc. From a study of the distribution of the species determined the author concludes that the plant-bearing beds belong to the Lower Coal-measures, and from their occurrence, in small basins in eroded limestone, the approximate age of the lead and zinc ores occurring in the limestone is estimated. Inasmuch as the palæobotanist is often criticised by the botanist for publishing descriptions founded upon material which the latter considers fragmentary and defective, the following paragraph from the work is quoted in order to show the point of view of the former: "Any impression that possesses a character which marks it as different from all other impressions and as peculiar to a horizon or series merits a characterization sufficient for its complete distinction; for its value in identifying that horizon within certain limits is equally important, whether it be a good species to the eye of the systematic biologist, or only the track of an otherwise unknown organism." In other words, accuracy of description and location is the first essential. Systematic position is only incidental; and to those who appreciate the value of palæobotany in the correlation of strata and the determination of geological horizons this statement of the case appeals most forcibly.

A. H.

A New Ilysanthes.—While botanizing in the lowlands of southern Missouri this summer, my attention was attracted by a form of *Ilysanthes* that appears to have escaped the notice of botanists generally. It was so unlike anything I had ever seen that I was constrained to observe it more closely at the different localities I collected in, and I found that it is the prevailing form of southeastern Missouri; at least I observed it in Dunklin, New Madrid, Stoddard, Scott and Cape Girardeau counties. In aspect it is the exact opposite of *I. gratioloides*, and may be characterized as follows:

Decumbent, low and spreading bushy annual; leaves round-ovate or oblong-ovate, thinnish, very veiny, serrate, or often coarsely dentate, all of them petioled, the lower quite long-petioled; pedicels thickish, less than 12 mm. long, and much shorter than the leaves, and commonly two or three in the axils: flowers about 3 mm. long; capsule small, acuminate at apex; calyx-lobes setaceous, much longer than the capsules.

Although there seem to be sufficient characters present to maintain this as a species, for the present it may be designated as ILYSANTHES GRATIOLOIDES CURTIPEDICELLATA.

Differs from *I. gratioloides* mainly in having larger thin leaves which are petioled, shorter pedicels, longer calyx lobes, several pedicels in the axils, decumbent habit and in being slightly scabrous. *I. gratioloides* is usually strictly upright, with sessile, mostly entire leaves, the lower usually connate, pedicels solitary, filiform and much exceeding the leaves, sometimes even 36 mm. long, and has calyx lobes shorter than the capsules. B. F. Bush.

Independence, Mo.

Proceedings of the Club.

Tuesday Evening, October 9th, 1894.

Dr. Britton presiding and 26 persons present.

The following were elected active members; Miss Mary Foster, New York City; Miss Luella A. Palmer, New York City; Miss L. K. Lawall, New York City; Mr. Paul Schoeder, Hoboken, New Jersey; Mr. Edw. W. Berry, Passaic, New Jersey.

Prof. Dr. Alfred Cogniaux cf Verviers, Belgium, was elected an honorary member.

The Committee on Coöperation of the Scientific Alliance with the Brooklyn Institute, for entertaining the A. A. A. S. at its Brooklyn meeting, reported that the Local Committee of Arrangements had requested that no demonstration be made in this city, but that all unite in making a success of the undertakings in Brooklyn, and that this request had been complied with.

It was unanimously resolved that the Curators request the College of Pharmacy of the City of New York to permit the local herbarium of the Club to be deposited in the herbarium room of the new College of Pharmacy building, and to allow the members of the Club access thereto, the College in return being permitted to use the Club herbarium.

The Secretary reported a request from Prof. Dr. Rees of Erlangen for specimens of American plants in the families Scrophulariaceæ, Gentianaceæ, Plantaginaceæ and Liliaceæ, which Prof. Rees is engaged in monographing, and announced that he would forward to Prof. Rees any such specimens which might be sent to him.

Dr. Britton announced the death of Mrs. Maria L. Daly, and eulogized the high services which she had rendered the cause of

Botany in starting and heading the ladies' movement for the establishment of the New York Botanical Garden, which had resulted in the resuscitation of the enterprise when it was virtually dead for the time being, and in making in her will a very handsome provision for its maintenance. It was unanimously resolved that a committee of three be appointed by the Chair to draft suitable resolutions in memory of the deceased. Judge Brown, Miss Vail and Mrs. Cowdin were appointed.

Mr. Van Sickle reported finding in Green Pond, N. J., two large patches of *Sparganium minimum* Fries, the floating stems being about four feet in length. This is the first definite record of the occurrence of the plant in New Jersey. Dr. Britton remarked that it was probably the most southern locality known for the plant. Mr. Van Sickle had also found in abundance a hybrid between *Verbena urticæfolia* and *V. hastata.*

Mr. Small had spent his time in Georgia and North Carolina in making field observations. He had endeavored to ascertain how the flora of similar elevations in the centers of the two States compared, and had found them very similar. A number of species heretofore supposed to be endemic in central Georgia had been found in North Carolina. He had collected many rare and several new species. Important facts concerning altitudinal distribution had been collected.

Interesting observations concerning the rapid spread of *Helenium tenuifolium* Nutt. were made, and also concerning the distribution of *Rhododendron maximum;* Miss Waterman reported having seen the latter at Sebago Lake, Maine, which is believed to be its most eastern locality.

Mr. Ogden reported having explored an uninhabitated region in Pike county, Pa., where the forest had been felled and had apparently smothered out many species before abundant, notably *Cypripedium pubescens. Gerardia flava* was the predominant plant in flower, covering acres with bloom. A specimen of *Peramium pubescens* having fifty flowers in bloom at one time had been seen. Abundantly represented species were *Habenaria ciliaris, Rhododendron maximum, Epigæa repens* and *Azaleas.* In Sullivan county, Pa., he had observed an injured branch of *R. maximum*, which bloomed September 7th.

Mrs. Britton reported having found five stations for *Schistostega osmundacea* in the Adirondacks, near Adirondack Lodge. She stated that *Ptychomitrium pygmæum* Lesq. and James is only *P. incurvum.*

WEDNESDAY EVENING, OCTOBER 31ST, 1894.

Vice President Allen in the chair and 20 persons present.

The following named persons were elected active members: Mr. T. S. Constantine, Jr., Miss Catharine Barker, New York City.

An invitation was received from the President of the New York College of Pharmacy, offering the Club the use of the Assembly Rooms of that institution on any evening mutually agreed upon, and also to inspect the new building. The invitation was gratefully accepted and the arrangements were referred to the Recording Secretary with power.

The Chairman reported some of the results of an examination of the Characeæ of Lake Champlain and Lake Saratoga during the summer. He had found the west side of Lake Champlain almost barren of these plants, but had collected a new form of *Chara sejuncta* and *Chara gymnopus elegans* in Great South Bay, an arm of that lake. The same two species were found in Lake Saratoga. He exhibited *Nymphæa rubrodisca* from Lake Champlain and *Bidens Beckii* from Lake Saratoga.

Dr. Britton reported the occurrence of Coltsfoot, *Tussilago Farfara*, near Garretson's, Staten Island, and remarked on the rarity of this plant in the area of the local flora, stating that it was reported many years ago by Dr. Knieskern from Monmouth county, N. J., and that he had himself once observed it near Port Jervis, in southern New York.

Mr. Barnhart reported the occurrence of *Alliaria Alliaria* near Hastings, N. Y.

The following announced papers were then presented:

"On wing-like Appendages on the Petioles of *Liriophyllum populoides* Lesq. and *Liriodendron alatum* Newb., with Description of the latter," by Arthur Hollick. (Published in this BULLETIN.)

"Notes on a Revision of the Genus *Scouleria* with Description of a new Species," by Elizabeth G. Britton. (To be published in the December BULLETIN.)

"On the Affinities of the Calycanthaceæ, with Notes on the Family," by T. H. Kearney, Jr. (To be published in a subsequent issue of the BULLETIN.)

Index to recent Literature relating to American Botany.

Atkinson, G. F. Leaf Curl and Plum Pockets. Bull. N. Y. (Cornell) Exp. Sta. 73: 318–355. *pl. 1–20.* 1894.

Eight of the fifteen species of *Exoascus* figured are described as new.

Baker, J. G. New Ferns of 1892–93. Ann. Bot. 7: 121. Au. 1894.

Asplenium (*Diplazium*) *Cordovense* from Mexico collected by Hugo Finck is the only American species described.

Bastin, E. S. Economic Botany. Am. Journ. Pharm. **66**: 283–293. Je. 1894.

Bastin, E. S. Structure of *Geranium maculatum.* Am. Journ. Pharm. **66**: 516–522. N. 1894.

Bastin, E. S. Structure of *Heuchera Americana.* Am Journ. Pharm. **66**: 467–473. O. 1894.

Bastin, E. S. Structure of *Podophyllnm.* Am. Journ. Pharm. **66**: 417–424. S. 1894.

Beal, W. J. Ruled Slides. Bot. Gaz. **19**: 416. 17 O. 1894.

Brandegee, K. Studies in Portulacaceæ. Proc. Cal. Acad. Sci. (II.) 4: 86–91. *pl. 4.* 2 Je. 1894.

Contains descriptions of *Lewisia redeviva* var? *Yosemitana* and *L. Kelloggii,* the latter figured.

Brandegee, T. S. Two new Species of *Ilex.* Gard. & For. 7: 414. *f. 65–66.* 17 O. 1894.

Descriptions and illustrations of *Ilex Californica* and *I. triflora.*

Brown, N. E. *Hypocryta pulchra.* Gardn. Chron. **16**: 244. 1 S. 1894.

A new species from Columbia, prov. New Grenada.

Clinton, G. P. New Localities. Bot. Gaz. **19**: 415. 17 O. 1894.

Plants introduced in Illinois.

Coulter, Barnes and **Arthur, Editors.** Proceedings of Section G., A. A. A. S., Brooklyn meeting, 1894. Bot. Gaz. **19**: 362–382. 15 S. 1894.

Davenport, G. E. Filices Mexicanæ.—V. Bot. Gaz. **19**: 389–396. 17 O. 1894.

Enumeration of Pringle's collection of 1891–3. Describes *Asplenium rubinum* and *Polypodium petiolatum* as new and gives names to several varieties.

Davis, J. J. Two Wisconsin Fungi. Bot. Gaz. **19**: 415–416. 17 O. 1894.

Describes *Uromyces minimus* and *Doassansia ranunculina* as new.

DeCandolle, C. Meliaceæ Novæ. Bull. Herb. Boissier, **2**: 567–575. Au. 1894.

New American species described in *Guarea, Trichilia* and *Cedrela.*

Eckfeldt, J. W. Lichens new to North America. Bull. Torr. Bot. Club, **21**: 393–396. 29 S. 1894.

Describes eight new species from Mexico and one from Louisiana.

Engelhardt, H. Ueber neue fossile Pflanzenreste von Cerro de Potosi. Abh. Isis, **1894**: 3–13. *pl. 1.* 1894.

Includes descriptions of thirty-four new species.

Fairchild, D. G. Bordeaux Mixture as a Fungicide. Bull. Div. Veg. Path. U. S. Dept. Agric. **6**: pp. 56. Je. 1894.

Lists 33 injurious Fungi that have been treated.

Farlow, W. G. Note on *Agaricus amygdalinus* M. A. Curtis. Proc. Bost. Soc. Nat. Hist. **26**: 356–358. Au. 1894.

Farwell, O. A. Contributions to the Botany of Michigan. Asa Gray Bull. **6**: 35; **7**: 45. 1894.

Cardamine Pennsylvanica Brittoniana n. var. is described; many new localities for Michigan plants are recorded.

Galloway, B. T. The Journal of Mycology 7: 4. Div. Veg. Path. U. S. Dept. Agric. 333–478. *pl. 32–38.* 1894.

Deals chiefly with methods of combating Fungi.

Gibson, R. J. Contributions towards a Knowledge of the Anatomy of the Genus *Selaginella.* Ann. Bot. **7**: 131–206. *pl. 9–12.* Au. 1894.

Groppler, R. Vergleichende Anatomie des Holzes der Magnoliaceen. Bibliog. Bot. 31: 1–49. *pl. 1–4.* 1894.

Harvey, F. L. Contribution to the Lichens of Maine. Bull. Torr. Bot. Club, **21**: 389–393. 29 S. 1894.

Preliminary list of 115 species.

Hooker, J. D. *Salvia macrostachya.* Curt. Bot. Mag. **50**: *pl. 7372.* S. 1894.

Native of Ecuador.

Hooker, J. D. *Sobralia sessilis.* Curt. Bot. Mag. **50**: *pl. 7376.* S. 1894.

Native of British Guiana.

Hooker, J. D. *Trichocentrum tigrinum.* Curt. Bot. Mag. **50**: *pl. 7380.* O. 1894.

Native of Central America.

Jack, J. G. Native Trees and Shrubs about Montreal, Canada.—I.–V. Gard. & For. **7**: 383–384; 392; 403–404; 413; 423. 3–24 O. 1894.

Jelliffe, S. E. A further Contribution to the Knowledge of the Microscopical Organisms of the Brooklyn Water Supply. Brooklyn Medical Journal, **8**: 588–605. O. 1894.

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Kraemer, H. Fungi. Am. Journ. Pharm. **66**: 424. S. 1894.

Kuntze, O. Nomenclatur-Studien. Bull. Herb. Boissier, **2**: 456–489. Jl. 1894.

Kuntze, O., and **Jackson, B. D.** *Linnæa* or *Obolaria?* Journ. Bot. **32**: 276. S. 1894.

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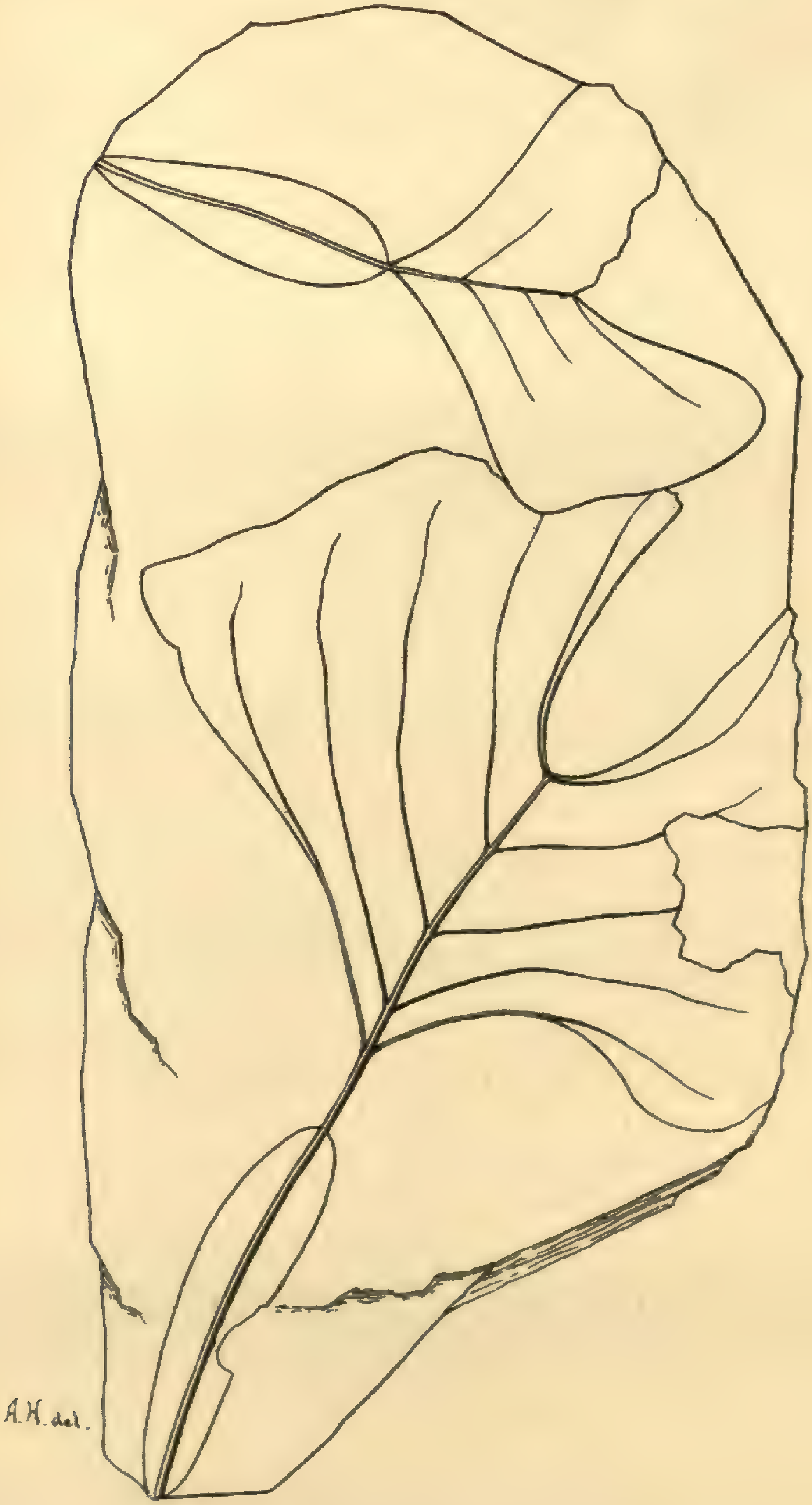

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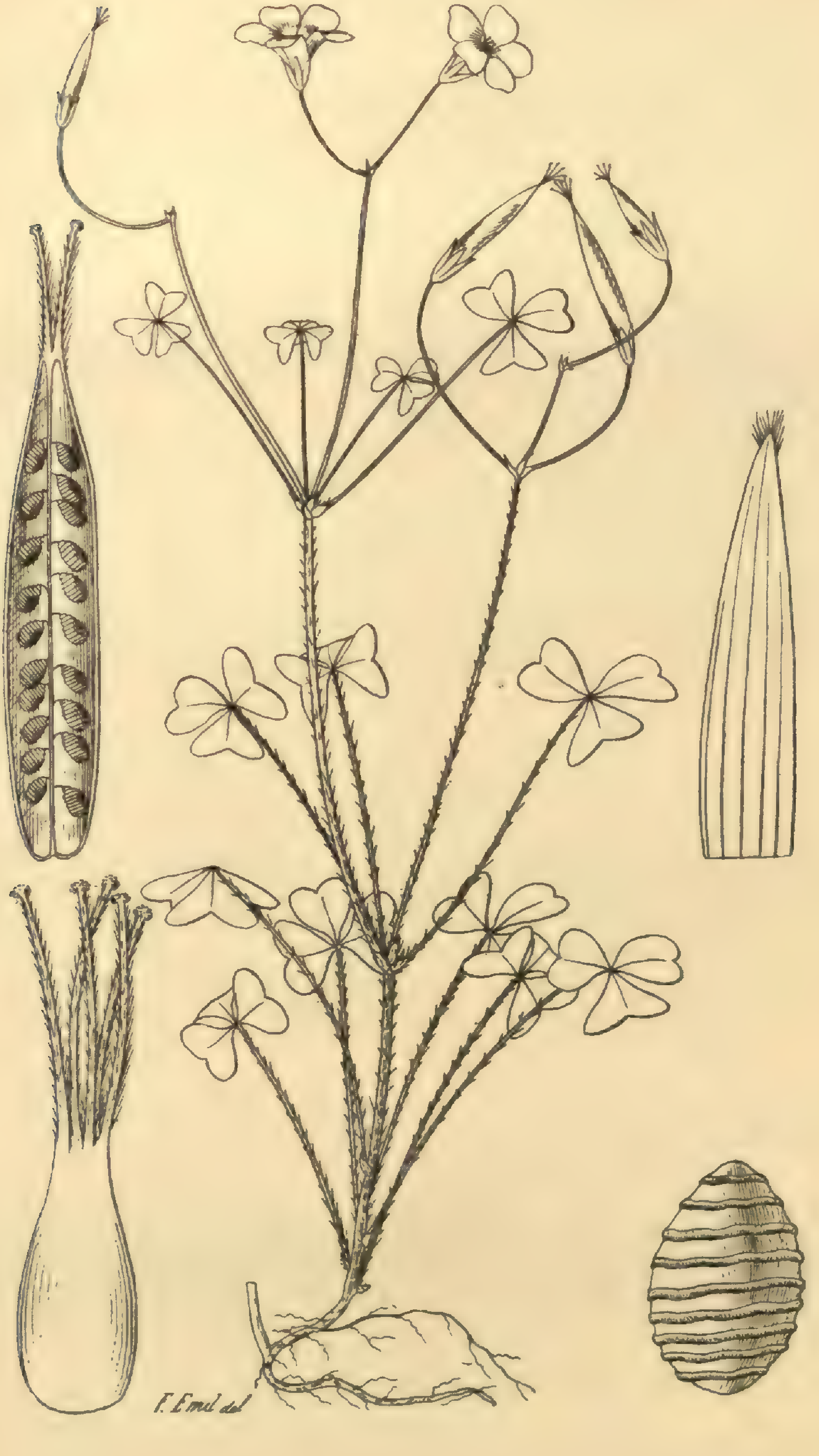

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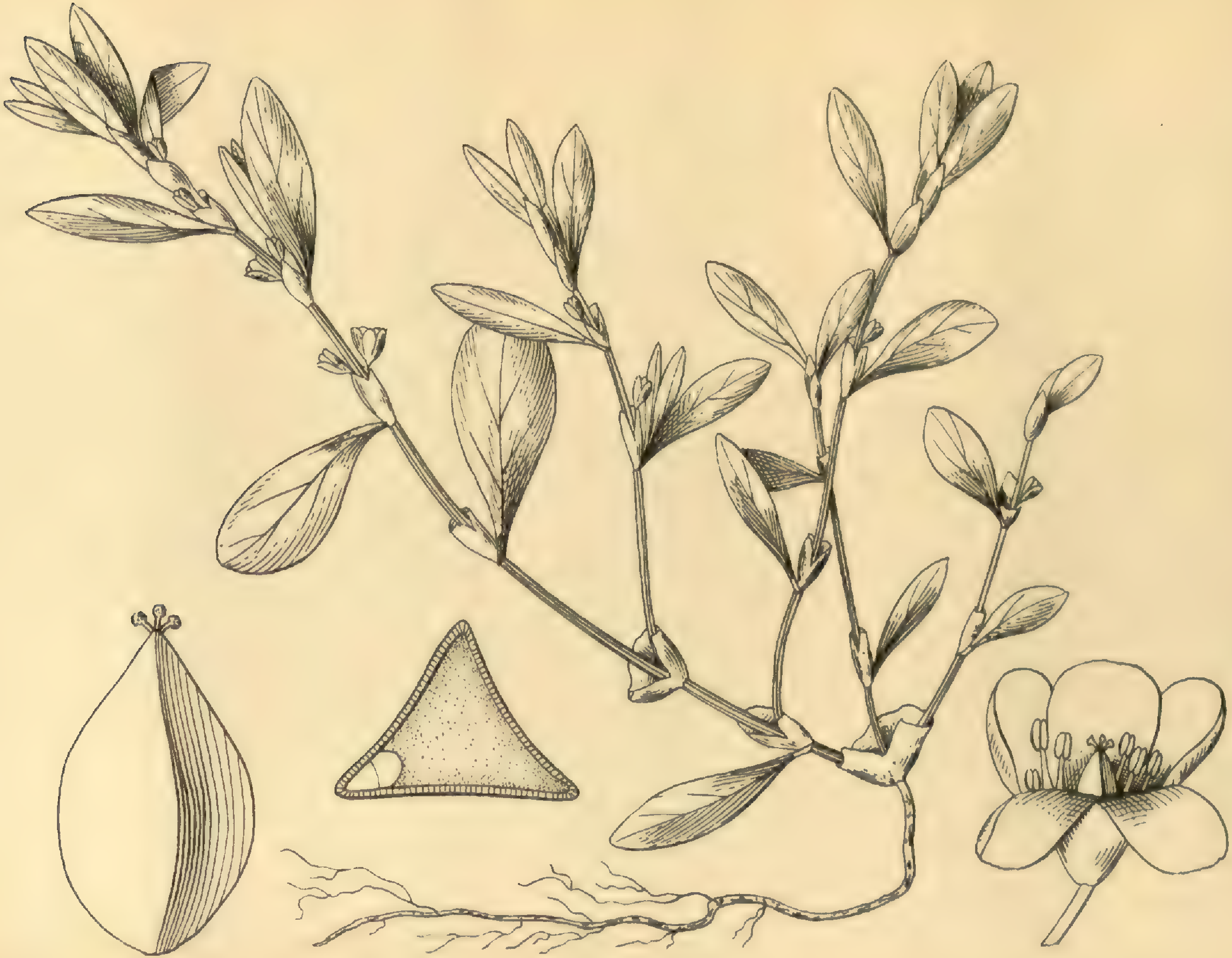

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VOL. 21. DECEMBER, 1894. No. 12.

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TORREY BOTANICAL CLUB.

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EDITED BY

NATHANIEL LORD BRITTON,

AND OTHER MEMBERS OF THE CLUB.

CONTENTS:

PAGE.
Notes on Maize: *E. Lewis Sturtevant* (continued) 503
Japanese Characeae—I.: *T. F. Allen* . . . 523
Note on *Chara sejuncta* A. Br.: *T. F. Allen* 526
Orthotrichum gymnostomum Bruch.: *G. N. Best* 527
Microsphaera densissima (Schwein.) Peck: *Geo. F. Atkinson* 528
Fissidens hyalinus in Pennsylvania: *Alonzo Linn, Jas. S. Simonton* 529
PROCEEDINGS OF THE CLUB 530
REVIEWS.—Contributions to Lichenology; Flora of Nebraska; New fossil Plants from Cerro de Potosi 532
INDEX TO RECENT LITERATURE RELATING TO AMERICAN BOTANY 535

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BULLETIN
OF THE
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Vol. 21. Lancaster, Pa., December 24, 1894. No. 12.

Notes on Maize.

BY E. LEWIS STURTEVANT.

XI.

My own experiments on the pollination of corn have been from the planting of many varieties and seed-selections in juxtaposition, and then studying the crop produced. Where commercial seed or named samples were used, and the crop critically examined for off kernels, the result was:

Zea everta. 1883, one variety, all pop kernels; 1884, five varieties, all pop kernels; 1885, three varieties, all pop kernels.

Zea indurata. 1883, ten varieties, all flint kernels; 1884, nineteen varieties, all flint kernels; 1885, three varieties, all flint kernels.

Zea indentata. 1883, twelve varieties, all dent kernels; 1884, eleven varieties, all dent kernels; 1885, two varieties, and one had some flint kernels.

Zea amylacea. 1883, one variety, and some flint kernels; 1884, nine varieties, and all soft kernels; 1885, four varieties, and one had some flint kernels.

Zea saccharata. 1883, twenty-seven varieties, and of these twenty-four had some flint kernels; 1884, thirty-five varieties, and of these five had some dent kernels, and twenty-nine had some flint kernels; 1885, ten varieties, and of these two had some dent kernels, five had some flint, one had some flint and soft, and one had some flint, dent and soft kernels.

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* Continued from BULLETIN, Aug. 1894, p. 343.

We hence would conclude that current fertilization, or the effect of the pollen of the same year, is not facile between the species except in the case of the sweets. Professor Kellerman, of the Kansas Experiment Station, in the Report for 1888, p. 331, gives the result of artificial crossings, as below:

Pop × dent. 1 trial. No evidence of a cross.
Flint × pop. 1 trial. " "
Flint × flint. 3 trials. " "
Flint × dent. 7 trials. " "
Flint × sweet. 1 trial. " "
Dent × pop. 2 trials. No certain evidence of a cross.
Dent × flint. 4 trials. No evidence of a cross; 1 trial, slight evidence of a cross.
Dent × dent. 6 trials. No clear evidence of a cross.
Dent × sweet. 2 trials. No evidence of a cross.
Sweet × pop. 3 trials. Clear evidence of a cross.
Sweet × flint. 1 trial. Doubtful evidence of a cross; 2 trials, clear evidence of a cross.
Sweet × dent. 1 trial. No evidence of a cross; 2 trials, apparent evidence of a cross.
Sweet × sweet. 3 trials. No evidence of a cross.

Thus the evidence collected by two different methods give results in unison; as shown more clearly below:

Female parent.	Sturtevant.	Kellerman.
Zea everta.	No evidence in favor.	No evidence in favor.
indurata.	do	do
indentata.	Slight evidence in favor.	Slight evidence in favor.
amylacea.	do	—
saccharata.	Much evidence in favor.	Much evidence in favor.

That corn will self-fertilize seems evident from the always finding of kernels, and occasionally well-filled ears, on plants from single kernels that either accidentally or purposely have grown remote from other plantings of their kind. This positive evidence, perhaps not conclusive on account of the facility by which pollen is moved by the wind, seems to me to outweigh the negative results reported by observers for definite trials.

That corn cross-fertilizes readily is evident to the most careless observer. Even the Indians of New England had noticed the fact, but had attributed the cause to the roots reaching to and communicating with each other. The result of inter-crossings, as expressed in the ears, and given below from the data obtained from the use of seed grown under conditions that almost compelled interchange of pollen, and some of the seed taken from ears of other varieties or species than their own.

Zea everta. 1883, nineteen plantings, of these seven produced pop and flint ears, twelve produced all pop ears; 1884, eight plantings, of these one produced pop and flint ears, and seven all pop ears; 1885, fourteen plantings, all produced pop ears.

Zea indurata. 1883, nine plantings, of these three produced flint and dent ears, one produced flint, dent and soft ears, and five produced all flint ears; 1884, seventeen plantings, of these three produced flint and dent ears, one produced flint and pop ears, one produced flint, dent and pop ears, one produced flint and soft ears, and eleven produced all flint ears; 1885, twenty-eight plantings, of these three produced flint and pop ears, three produced flint and dent ears, one produced flint and sweet ears, one produced sweet and pop ears, and twenty produced all flint ears.

Zea indentata. 1883, thirteen plantings, of these four produced dent and flint ears, one produced sweet and flint ears, and six produced all dent ears; 1884, ten plantings, of these three produced dent and flint ears, one produced dent, flint, soft and pop ears, and six produced dent ears alone; 1885, thirteen plantings, of these five produced dent and flint ears, one produced dent, flint and pop ears, and seven produced all dent ears.

Zea amylacea. 1883, six plantings, all producing soft ears; 1884, two plantings, both producing soft and flint ears; 1885, thirteen plantings, of these one produced soft and flint ears, and twelve produced all soft ears.

Zea saccharata. 1883, five plantings, of these two produced sweet, pop and flint ears, one produced sweet and pop ears, and two produced all sweet ears; 1884, ten plantings, all producing sweet ears; 1885, forty-one plantings, of these one produced sweet and dent ears, one produced sweet and flint ears, one produced all flint ears, and thirty-eight produced all sweet ears.

This presentation is an interesting one, but it does not show the full significance, nor the part that atavism has furnished. It will be noticed that the ears noted are all of the species named, and that there are no intermediates. I propose hence to examine the crop of 1885, the seed used having been all exposed to cross-fertilization in 1884, and much of it in 1883 and 1884. The varieties as named were all compared with authentic specimens or with careful drawings. Variables which could not be named were passed by, as are also those plantings whose crop was all true to type. I have added to each name the letters A, B or C, indicating the sub-species.

Zea everta seed.

Quarantino (C). Yielded some ears of New England Twelve-rowed pop (B). A few flint kernels in crop.

White Pearl (C). Yielded some ears of Red Pearl pop (C).

Small White Pearl (C). Yielded some ears of Common Twelve-rowed pop (C).

New England Yellow (A). Yielded some ears of New England pop (A), and some of Egyptian pop (C).

Purple Rice (C). Yielded some ears of Yellow Egyptian pop (C), and some of Red Pearl pop (C).

Pearl (C). Yielded some ears of Small Pearl pop (C). A few sweet kernels in the crop.

Red Pearl (C). Yielded some ears of White Pearl pop (C).

Twelve-rowed from Amber Rice seed (C). Yielded some ears of Yellow New England pop (A), and some ears of Red New England pop (A).

Amber Rice (C). Yielded some ears of Twelve-rowed pop (B), and some ears of Egyptian pop (C).

Amber Rice (C). Yielded some ears of Red Rice pop (C), and some ears of New England pop (A).

Zea indurata seed.

French Yellow Six Weeks (C). Produced some ears of Quarantino pop (C).

Compton's Early (B). Produced some ears of Canada Twelve-rowed flint (B). Some sweet kernels in crop.

New England Eight-rowed (A). Produced some ears of Long Yellow flint (A), some ears of Canada Twelve-rowed flint (B). Some sweet kernels in crop.

Maize from Africa A (C). Produced some ears of African E. 3 dent, but yellow kernelled (C).

White flint kernels from Egyptian sweet (C). Produced some ears of Egyptian pop, some ears of Canada flint (A), and some ears of Chinese Golden flint (C). Some sweet kernels in crop.

Rural Thoroughbred (A). Produced some ears of Rhode Island White Cap flint (A), and some ears of Benton dent (A).

Flint kernels from Benton dent (A). Produced some ears of Benton dent (A), some ears of Eight-rowed Brown flint (A), and some ears of Orange flint (A).

Black flint kernels from Black Mexican sweet (A). Produced some ears of Black Mexican sweet (A), and some ears of Black Sugar sweet (B). Some flint kernels in the crop.

Flint kernels from Early Minnesota sweet (A). Produced some ears of Genesee sweet (B), and some ears of New England pop (A). Some flint kernels in the crop.

Canada Twelve-rowed (B). Produced some ears of Canada flint (A), and some ears of Early Fulton flint (B). Some sweet kernels in the crop.

Golden Dew Drop (A). All the ears Canada flint (A), and Canada Twelve-rowed flint (B).

Purple New England Eight-rowed (A). Produced some ears of Canada flint (A), and some ears of Waushakum flint (A). Some sweet kernels in the crop.

Flint kernels from Moore's Early Concord sweet (B). Produced some ears of New England pop (A), some ears of Canada flint (A), some ears of New England Eight-rowed flint (A), some ears of Chinese Golden flint (C), and some ears of African E. 2 flint (C). Some sweet kernels in the crop.

Sanford (A). Produced some ears of Silver White flint (A).

Flint kernels from Golden sweet (B). Produced some ears of Chinese Golden flint (C), some ears of Canada flint (A), and some ears of Canada Twelve-rowed flint (B). Some sweet kernels in the crop.

Flint kernels from flint kernels in Sibley's Pride of the North dent (C). Produced mostly ears of Waushakum flint (A), and some ears of Mandan flint (A).

Flint kernels from Marblehead Mammoth sweet (B). Produced some ears of Canada flint (A), and some ears of White Pearl pop (C). Some sweet kernels in the crop.

Blue flint kernels from flint kernels on Golden sweet (B). Produced some ears of Canada flint (A), and some ears of New England Eight-rowed flint (A). Some sweet kernels in the crop.

Flint kernels from Mandan soft (A). Produced all Connecticut White flint (A) ears.

Improved Early Canada (A). Produced some ears of Smedley dent (C), some ears of Canada flint (A), and some ears of New England Eight-rowed flint (A).

Zea indentata seed.

Dent kernels from Landreth's Sugar sweet (C). Produced some ears of Forty Days flint (A), some ears of African E. 1 flint (C), and some ears of Chinese Golden flint (C) in white kernels.

Dent kernels from flint on Early Eight-rowed sweet (A). Produced some ears of Benton dent (A), some ears of Adams' Early dent (C), and some ears of Illinois Yellow dent (C). Some sweet kernels in the crop.

Chester County Mammoth (C). Produced some ears of Sanford flint (A).

Dent kernels from Ne Plus Ultra sweet (C). Produced some ears of Chinese Golden flint (C), but white kernelled, some ears of Egyptian pop (C), and some ears of Canada Twelve-rowed flint (B). Some sweet kernels in the crop.

Adams Early (C). Produced some ears of Benton dent (A), and some ears of Long Island dent (A).

Benton dent (A). Produced some ears of Waushakum flint (A).

Dent kernels from flint on Sibley's Pride of the North (C). Produced some ears of Smedley dent (C), some ears of Waushakum flint (A), and some ears of Eight-rowed Brown flint (A).

Adams Early (C). Produced some ears of Benton dent (A), and some ears of Long Island dent (A).

Champion White Pearl (C). Produced some ears of Adams Early dent (C).

African Maize E. 3 (C). Produced some ears of Chinese Golden flint (C), some ears of Waushakum flint (A), and some ears of Benton dent (A). Some sweet kernels in the crop.

Sibley's Pride of the North (C). Produced some ears of Smedley's dent (C).

Zea amylacea seed.

Red River (A). Produced some ears of Mandon soft (A).

Zuni Yellow (B). Produced some ears of Zuni Purple soft (B), and some ears of Canada flint (A).

Omaha (A). Produced some ears of Canada flint (A) in red color.

Zea saccharata seed.

Amber sweet kernels from Brighton Orange sweet (B). Produced some ears of Tom Thumb sweet (A), and some ears of Orange sweet (B). Some flint kernels in the crop.

Early Marblehead (A). Produced some ears of Amber Queen sweet (B). Some flint kernels in the crop.

Golden sweet kernels from flint on Golden sweet (B). Produced some ears of Golden Eight-rowed sweet (A), and some ears of Black Mexican sweet (A). Some flint kernels in the crop.

White sweet kernels from New England pop (A). Produced some ears of Darling's Early sweet (A), and some ears of Marblehead sweet (A). Some flint kernels in the crop.

White sweet kernels from New England pop (A). Produced some ears of Minnesota sweet (A), and some ears of Amber Cream sweet (B). Some flint kernels in the crop.

Minnesota (A). Produced some ears of Eight-rowed Early sweet (A), and some ears of Amber Cream sweet (B). Some flint kernels in the crop.

Moore's Early (B). Produced some ears of Golden Eight-rowed sweet (A). Some flint kernels, and some dent kernels in the crop.

Black sweet kernels from flint on Golden sweet (B). Produced all Black Mexican sweet (A) ears. Some flint and some soft kernels in the crop.

Asylum (B). Produced some ears of Amber Cream sweet (B), and some ears of Crosby's Early sweet (B). Some flint kernels in the crop.

Alexander's sweet (A). Produced some ears of Amber Cream sweet (B), and some ears of Eight-rowed Early sweet (A). Some flint kernels in the crop.

Black sweet kernels from Brighton Orange sweet (B). Produced all Black Mexican sweet (A) ears. Some flint kernels in the crop.

Dolly Dutton (A). Produced some ears of Narragansett sweet (A). Some flint kernels in the crop.

Black sweet kernels from Crosby's Early sweet (B). Produced some ears of Black Sugar sweet (B), some ears of Crosby's Early sweet (B), and some ears of Dwarf Early sweet (A). Some flint kernels in the crop.

Half sweet and flint on same kernels from Crosby's Early sweet (B). Produced some ears of Eight-rowed Early sweet (A), but kernels all black, and some ears of Crosby's Early sweet (B). Some flints kernels in the crop.

Black Mexican (A). Produced some ears of Amber Cream sweet (B), but black kernelled. Some flint kernels in the crop.

Ne Plus Ultra (C). Produced some ears of Eight-rowed Early sweet (A), and some ears of Hickox sweet (B). Some flint, some soft and some dent kernels in the crop.

Yellow sweet kernels from flint on Early Eight-rowed sweet (A). Produced some ears of Golden Eight-rowed sweet (A), some ears of Golden sweet (B), and some ears of Benton dent (A). Some flint kernels also in the crop.

Half sweet and flint in same kernel from Early Minnesota sweet (A). Produced some ears of Minnesota sweet (A), some ears of Narragansett sweet (A), and some ears of Eight-rowed Early sweet (A). Some flint kernels in the crop.

Black sweet kernels from Brighton Orange sweet (B). Produced some ears of Orange sweet (B), and some ears of Black Mexican sweet (A). Some flint kernels in the crop.

White sweet kernels from Brighton Orange sweet (B). Produced some ears of Tom Thumb sweet (A), and some ears of Crosby's Early sweet (B). Some flint kernels in the crop.

Tom Thumb (A). Produced some ears of Minnesota sweet (A). Some flints and some some soft kernels in the crop.

Dwarf Early (A). Produced some ears of Eight-rowed Early sweet (A), and some ears of Crosby's Early sweet (B). Some flint kernels in the crop.

Landreth's Sugar (C). Produced some ears of Long Yellow flint (A). Sweet kernels and dent kernels in the crop.

Marblehead Mammoth (B). Produced some ears of Genesee sweet (B). Some flint and many dent kernels in the crop.

Amber Cream (B). Produced some ears of Crosby's Early sweet (B). Some flint kernels in the crop.

Black Mexican (A). Produced some ears of Black Sugar sweet (B). Some flint, some soft and some dent kernels in the crop.

Squantum (C). Produced some ears of Genesee sweet (B). Some flint, some dent and some soft kernels in the crop.

Egyptian sweet (C). Produced some ears of Crosby's Early sweet (B). Some flint and some dent kernels in the crop.

The number of plantings that produced off and named ears and off kernels in their crop, according to their species, are summarized in the following table:

	No. of plantings.	Pop.		Flint.		Dent.		Soft.		Sweet.	
		Ears.	Kernels.	Ears.	Kernels.	Ears.	Kernels.	Ears.	Kernels.	Ears.	Kernels.
Zea everta, ...	10	—	—	0	1	0	0	0	0	0	1
Zea indurata, ...	20	5	5	—	—	4	4	0	0	2	11
Zea indentata, ...	11	1	1	6	6	—	—	0	0	0	3
Zea amylacea, ...	3	0	0	2	2	0	0	—	—	0	0
Zea saccharata, ...	28	0	0	1	28	1	8	0	5	—	—

This phenomena of atavism, as the outcome of the crossing of corn, has apparently escaped the notice of writers, and the testimony here furnished is in evidence of its frequent occurrence.

In 1882 seed of Waushakum flint was planted alongside many other varieties, and exposed to crossings of many sorts. No influence of other pollen was observed in the crop. In 1883 seed from the 1882 crop was again planted on a half-acre area greatly exposed to the pollen of over 100 kinds. In this crop no influence of other varieties was to be seen. In 1884 the same condition of things, and the resulting crop purely on type. So again in 1885. We have here a strong piece of evidence in favor of the resistance to crossing from plants from pure seed. Similar instances are afforded by the Silver White flint and the Minnesota dent. The former has been the only variety grown from time immemorial by the few farmers in a secluded valley in Orange county, N. Y., and the latter seems to be the only variety of dent grown near Ogdensburg, N. Y. *Per contra*, one plot of Waushakum flint was alongside a plot of Minnesota dent in 1882. In 1883 seeds from both plots yielded a crop of corn partly Minnesota dent and partly Waushakum flint, and no intermediates.

It is to the rarity of intermediates and the prevalence of atavism that we may look for the explanation of the frequent statements of flint changing to dent or dent to flint when seed has been obtained from distant localities; a result popularly ascribed to influence of climate. It is to be observed that the change is always towards the prevailing variety of the locality where the attempt is made. Let us offer a supposed instance for illustration. A farmer in Maine, where flint corn is exclusively grown, plants some dent corn on trial. The plants become hybridized from the neighboring plants. The next year's sowing yields flint and dent ears, the former ripe, the latter immature at the period of harvest. The ripened seed, that is, the flint, is saved for next year's use. The next year the crop is almost entire flint, and the farmer certifies at his next corn-talk that dent always changes to flint in his climate. The result here is influenced in great part by an unconscious selection. This illustration also seems to hold true in explaining the statements that Canada flint becomes larger when removed southward. This may be true, but I know of no good evidence in favor of such a change being produced by climatic conditions alone, although I admit its possibility. The Dwarf Golden pop, very small kernelled, retains its character for years, as grown by some farmers, not even changing to the very near but larger eared Golden pop of our seedsmen. One striking illustration may be offered. In 1883 I received some Minnesota dent corn from New York which had been grown near the Dutton flint. The ears and the kernels were apparently the true Minnesota dent. The crop was a flint corn, the dent character having largely disappeared. This change in variety receives again illustration in a planting of Dwarf Golden pop. The ears were from 1–2¼ in. long, with a bright yellow kernel. Thirty-six plants grew, of these thirty-two were two feet tall, the ears all like the seed except that one ear had a few sweet and flint kernels. The remaining four plants were four feet tall, and the kernels were all sweet, flint or Tuscarora soft, with not a pop among them.

From the data we have given it would seem that there is a ready cross-fertilization within each species, and a resistance, not very complete, to hybridization. But more work is yet required before accepting this conclusion.

In this "note" I have sought to indicate how nomenclature can be applied to simplify the study of such a confused mass of material as is furnished through the crossing of maize.

XII.

May 14, 1894, I received from Dr. Wm. Saunders, Director of the Canada Experimental Farms, a sample of the Squaw flint corn grown at Rat Portage, Lake of the Woods, lat. 50° N. The description of this variety, as made out from the cob and detached grains, is as below. Ear eight-rowed, six inches long; the ear stalk large. The taper quite pronounced from the slight dichotomous openings towards the butt, and the decreased breadth of the kernels towards the tip. Kernels broader than deep, very flinty, but the corneous matter rather thin; the larger ones $\frac{7}{16}$ inch broad. Colors mixed, some kernels dingy white, others of shades of yellow, light purple or blue. The cob, rather squarish in section, and white; the interior reddish, the pith soft and well defined. This variety seems to be the same with the Blue flint of Northern New England, but the ear tapering and more squarish, although not more so perhaps than in individual selections from a crop of the Blue corn. The dichotomous arrangement of the kernels and the openness between pairs can be understood by examining specimens of flint tassel corn. It will be noticed with this tassel corn that the tassel branch becomes changed on one side to a kind of triangular cob bearing two rows usually, when many kernels are found, although single kernels may occur in a scattered way. If four of these dichotomous kernelled branches be collected and tied together to form an ear we would have an eight-rowed ear with distinct openness between the pairs of rows. If search be made in a crop of flint corn we shall very likely find ears that are but partially kernelled, the kernels being scattered here and there only over the cob. These kernels are of the type of their species, but rounded through the removal of pressure against adjoining kernels, and often as thick as broad. The relations of these kernels to the cob are however of the greater interest. Where no kernels are found the cob is rather undeveloped; when the kernels are absent over a considerable space, even flimsy, but thickening again as the kernels appear. The cob hence varies in diameter according to the presence of kernels. If the observer is very fortunate he may find a cob with kernels in groups of different size. In this case he will observe that there is a tendency in the cob to develop according to the size of the kernels, as well as according to their number. We here have a plausible explanation for the taper in ears where the kernels diminish in size towards the tip; and this decrease in size of kernel, together with slight dichotomous openness in the upper portion, may give an ear of a most decided taper. I have frequently noticed in varieties of flint and sweet corn that the unripe ears always are tapering. This seems to be accounted for by the development of the kernel from the base upward; the butt kernels fertilizing first, the tip kernels last, and often quite an interval of time between. If these unripe ears be plucked at the period coincident with the commencement of the hardening process, or even in some cases slightly before, and allowed to continue the process of ripening from the stored material it will be noticed that the ear ripens but the taper remains, as the kernels do not increase equally in size. This explains, perhaps, the number of tapering ears in a belated crop of a variety whose normal ear would be described as cylindrical, but tapering towards the tip. This Squaw flint grown at a point somewhat near the extreme northern limit of the species, where the season is short, is, as we have seen, tapering, while the apparently same variety as grown in the Northeast is described as cylindrical or tapering very slightly at lower third. Since my description of Canada corn in 1884, as strictly of a cylindrical type, I have noted that I have observed among specimens of this type from northern localities some tapering ears. I have not sufficient data for generalization on this point, but it suggests itself that in any variety grown near its northern limit we should expect this variation to occur, a variation not incident to the variety, but to be ascribed to the accidental circumstance of harvest. Thus in the Black Mexican sweet, whose type of ears is cylindrical throughout, we often find belated ears which are distinctly tapering. This apparent change of type, as between normal and belated ears, is especially evident in the sweet corn, and has worked much confusion in the attempts at nomenclature.

We observe that our Squaw flint has various colored kernels on the cob. I readily pick out one dingy white, three shades of yellow, three shades of light purple, and two shades of blue. This mixture of colors is also to be noticed in the Mandan soft corns of Michigan and the Zuni soft corns of New Mexico, as also in others. Blue corn from Hanover, N. H., planted in 1884, yielded a crop described as copper-yellow, with some blue and slate-colored kernels, and many red-striped kernels. Whether these distinctly colored kernels arise through cross-fertilization or are a variety character can perhaps be determined by the planting of single kernels. It is possible that the colors from each seed come pure, and that the mixture is the result of current cross-fertilization between varieties. I have not the data for an answer. In my previous paper I have discussed current fertilization between species. Here I may be permitted to offer evidence of current fertilization between varieties as well. The experiment was with named varieties of flint corn, which, as experience has shown, would have yielded in all probability single colors had they been planted apart. As it was, these were planted subject to crossing from very numerous varieties of all the species. The colors grown together were white, yellow, red and purple pops; white, yellow, copper-red, purple and purple-brown flints; white, red and yellow dents; slate, pink, black, yellow and white softs; and white, amber and black sweets. The results noted for these flint corns were as below:

Forty Days' Early White. 34 ears, all flint. Yellow, white and pink striped kernels.

Eight-rowed Brown. 30 ears, all flint. Purple-brown, copper-red, yellow, red-splashed, slate and black kernels.

Eight-rowed red-glazed. 31 ears, all flint. Yellow, copper red, white, slate, red and splashed kernels.

Waushakum. Pure seed. 16 ears, all flint. Yellow kernels.

Waushakum. Station grown seed. 21 ears, all flint. Yellow, slate and red-splashed kernels.

Improved King Philip. 31 ears, all flint. Yellow, red-blazed, copper-yellow, black, slate, blotched and speckled kernels.

New England Twelve-rowed. 1 ear, all flint. Yellow and white kernels.

White flint. 28 ears, all flint. White, yellow, black and pink splashed kernels.

Red Nose White. 35 ears, all flint. White, yellow, pink, purple and blotched kernels.

Early Dutton. 29 ears, all flint. Slate, white, yellow and red splashed kernels.

Eight-rowed Purple. 23 ears, all flint. Purple, yellow, copper yellow and red-striped kernels.

Rural Thoroughbred. 15 ears, all flint. White, yellow and blue kernels.

Our Squaw flint is an eight-rowed corn. There seems to be a corelation between this and climate. In New England the great predominance of eight-rowed varieties is significant, yet there is an eight-rowed and a twelve-rowed Canada, but I have no record of the comparative frequency of the two varieties. The samples of soft corn sent me from the Red River region of Manitoba were eight-rowed, so also the dent varieties from Dakota. In my description of 44 varieties of flint corn in 1884, 28 eight-rowed varieties are suited for New England growing, and 8 twelve-rowed, two varieties, twelve-rowed, being foreign and hence not ascribed to American location. Those varieties which are more distinctly Southern or Western comprise one twelve-rowed, and five over twelve-rowed. Yet, since writing the above, I have received a small twelve-rowed variety of a slate or bluish black pop, which is said to ripen in eighty days in Massachusetts.

XIII.

In 1878 I received from the Peabody Museum collection a sample of corn taken from a Peruvian Huaca, and figured the same in the New York Agricultural Experiment Station Report of 1884. I also saw another like ear from the Cambridge Botanical Museum. In August, 1894, I received from Professor F. W. Putnam three samples from the Peabody Museum representing three varieties from ancient burials. Wittmack, whose specimens came mostly from Ancon, Peru, is quoted by DeCandolle as testifying that the number of varieties were quite considerable. The only varieties that I have noted described are two. Rivero and Tschudi say the ears buried with the corpse were of two very rare kinds. In one the ear short, dry and a little curved at the point; the other a large thin ear, with large grains almost triangular at the point, very much twined, with the grains covering it like the tiles of a roof. He then mentions a "petrified" ear in the possession of the botanist Robert Brown, which was one of these varieties, and which he calls *Zea rostrata*, Bonafous. DeCandolle refers apparently to this "petrified" ear, but he calls it "un imitation sculpter." In the Department of Agriculture Report of 1870 there is figured an ear in the possession of the Smithsonian Institution which was taken from an earthern vessel eleven feet under ground, in a grave with a mummy. From the figure little can be made out except the irregular arrangement of the kernels, but the description says 4½ inches long, 13 rows, the grains rather sharp-pointed, small, slightly indented at the apex, lapping over each other. The appearance is that of a soft corn.

This datum, all I have, is scarcely sufficient for the purpose of a study or for generalizations concerning "mummy corns," but there are some few points that can be referred to, and an accurate description of the four varieties may be of service as a record. The kernel color of these Peruvian samples is uniform chocolate brown, or the same with a more reddish tinge; of the Chilian samples a port-wine glossy red. The brown-chocolate we assume is a change induced by age. The split kernels show all starchy matter, of a dull white, and no corneous matter. The species is hence *Zea amylacea*, but the question recurs whether or not the internal structure has been changed by age; this we cannot answer. The kernels in all are deeper than broad, hence subspecies C.

No. 1. Mummy corn from Peru. Ear-stalk small. Ears about 4 in. long and 2 in. in diameter, cone-form or strongly tapering from a large and rounded butt to a rounded tip, about 23 kernels in a row, 18-rowed. No sulci between rows. Kernels ⅝ in. long, ¼ in. broad, the apex flat with slightly rounded corners, and the sides but little tapering, hence rather rectangular in outline, indented, slanting forwards a little in their position on the cob, hence giving an appearance of imbrication to the ear. Color externally a chocolate brown, internally a dull white. Structure all starchy matter, hence *Zea amylacea*.

No. 2. Mummy corn from Ancon, Peru. Expedition of F. A. Agassiz. Ear-stalk small. Ear 4 in. long, 1½ in. in diameter, tapering but slightly, the kernels rounding strongly over butt and tip, 19 kernels to a row, 12-rowed. No sulci between rows. The kernels $\frac{5}{16}$ in. long, ⅜ in. broad, distinctly creased indented, the apex flattish, the corners well rounded, the sides slightly tapering, set upright or at right-angles with the cob. Color externally chocolate brown, internally a dingy white. Structure all starchy, hence *Zea amylacea*.

No. 3. Mummy corn from Ancon, Peru. Expedition of Geo. A. Dorsey, 1891. Ear-stalk small. Ear 5¼ in. long, 1¾ in. in diameter, not filled at extreme tip, no sulci between rows, very close kernelled, nearly cylindrical, kernels rounded strongly over butt, tapering and finally pointed towards tip, 26 kernels in a row, 16-rowed; the kernel surface compressed, leaving a flat triangular apex with the point forward. The kernel nearly ½ in. long by ¼ in. broad, the apex flat with very slightly rounded corners, triangular in shape, and a point projecting at right angles on the chit side, the sides slightly tapering, set upright on the cob, the point overlapping slightly the kernel in front, thus giving the appearance of imbrication. Color externally chocolate brown with a reddish tinge, internally a dingy white. Structure starchy throughout, hence *Zea amylacea*. This ear corresponds somewhat with the second variety of Rivero and Tschudi, but it is not *Zea rostrata*.

No. 4. Mummy corn from Iquique, Chili. Expedition of Geo. A. Dorsey, 1891. Ear-stalk small. Ear 3¼ in. long, 1½ in. diameter, tapering, rounded over butt and tip, no sulci between the rows, which are a little irregular, very close kernelled, about 17 kernels in a row, and 20-rowed. The kernels $\frac{7}{16}$ in. long, ¼ in. broad, strongly rounded at summit, tapering at the sides, set upright on the cob. Color externally a deep port wine glossy red, internally a dullish white, not as dingy as in Nos. 2 and 3. The structure all starchy matter, hence *Zea amylacea*. The general appearance of the specimen is that of a large kernelled very flinty pop corn. The kernels are so densely compressed that a horizontal section shows a polygonal outline, as is so readily observed in some varieties of Pearl pop.

XIV.

It is singular that nearly all the early corns mentioned in my Note II. were from Southern localities, as Nicaragua, Brazil and Paraguay. This was brought to my attention by noticing that the Cinquanto corn from Greece is one of the few varieties that ripens at Ottawa, Canada. The Danubian corn of Southeastern Europe, which to some extent enters into commerce, as near as I can find out, belongs to the Golden pop class, which is an early type, and Humboldt, it will be remembered, refers to a two-month variety in Hungary, the same as found in Nicaragua and on the banks of the Amazon river. The earliest variety I have ever grown is the Dwarf Golden pop which ripened in about 70 days from planting. The next earliest variety was the 40 days, a flint in some respects reminding of Canada flint, and which was ripe in 75 days, The only high Northern corn whose period of growth I find given is the Mitchell's Extra Early flint, gained by selection from the Native or Squaw flint of the Northwest. At Ottawa it required 110 days to ripen; at Nappan, Nova Scotia, 111 days in 1892, 126 days in 1893; at Agassiz, British Columbia, 138 days. In these regions it seems that this corn is harvested before it becomes as hard as with us.

The height of the corn plant varies considerably with the same variety, as also the time required to mature. Thus the Iowa

Experiment Station reports in 1888 on the Leaming dent, seed from four sources, as below:

	Height of plant.	Height of ear from ground	No. of blades to a stalk.	Days maturing.
Leaming (from Gregory)	9½ ft.	3¾ ft.	12	110 "
" (from Livingston)	9½ ft.	3¾ ft.	13	115 "
" (from Maule)	10¼ ft.	4¾ ft.	14	125 "
" (from Johnson & Stokes)	10½ ft.	5¼ ft.	15	128 days.

Further particulars from the State station reports are:

Leaming,	Illinois, 1888,	11¼ ft., tall.	Season 135 days.
"	Connecticut,	8 ft. tall.	
"	Ottawa, Can., 1889,	8 to 9 ft. tall.	
"	" " 1890.	7 to 10 ft. tall.	

Further illustrations are:

	Iowa, feet.	Illinois, feet.	New York, feet.	Ottawa, feet.
Adams' Early dent,	—	4¼ to 6½	5½	6 to 8
Minnesota Sweet,	4½ to 5	—	4½ to 5½	6 to 7

The height of the same corn in different years and planted at intervals of one week is given for Burr's White dent in the Illinois reports.

1891,	Eight plantings,	7⅚ to 8½ ft.,	Average 8 ft.
1892,	"	7⅙ to 9 ft.,	Average $8\frac{5}{12}$ ft.
1893,	Seven plantings,	$5\frac{7}{12}$ to 7⅔ ft.,	Average 6¾ ft.

Two well known varieties of sweet corn are Crosby's Early and Stowell's Evergreen, both largely grown and used for canning purposes.

	Crosby's Early, Height in feet.	Stowell's Evergreen, Height in feet.
Michigan,	4	5¾
Illinois,	5½ to 7	6 to 8
New York,	5½ to 6	5½ to 7½
Pennsylvania,	6	6
N. W. Territory, Can.,	4½	—
Manitoba,	7	5 to 5½
Ottawa, 1889,	6½ to 7	5½ to 7
" 1890,	4½ to 5	5 to 6½

Would it be safe, then, to generalize from these figures that a northern climate increased earliness and decreased size in the corn plant? Yet this is the popular belief. On the contrary our presentation shows no such conclusions.

The Canada Yellow is reported as 5 to 6 feet tall from Ottawa and Manitoba. Mitchell's Extra Early flint, at Ottawa, grows to a height of 5½ to 6½ feet. Canada flint, from the Province of Quebec, at New York station, 1884, grew 6½ feet tall; and the Canada Twelve-rowed, from P. Q., grew 6½ feet tall. These few observations, put in evidence, suggest also like interesting reflections.

I have as yet insufficient experience or study to venture upon a statement as to the influence of climate upon maize except in its most general relations; of one thing I am assured, and that is the permanence of variety types under varied conditions, in every case I have met where there was reasonable prevention of interpollenation with other varieties. Thus the Dwarf Golden pop, whose ovules are fertilized before other varieties come into bloom, is a permanent feature to some gardens. In Northern Maine, where the crop is only grown on hill-sides to escape the early frost of the lowlands, standing thus remote, the variety seems to have remained true from the earliest periods. At our local agricultural fairs the same variety is often exhibited year after year, and no apparent change within the memory of observers. A search in Northern Maine or New Hampshire brings to our knowledge a few fields of corn which is presumably the Blue corn of the aborigines. The corn found with the Arizona mummy at the National Museum seems identical with the varieties grown by the present Indians of that region. So far as I know, in any climate suited to corn culture, any variety that matures between the period of local planting and local frost will grow and keep its characters intact. Perhaps a greater knowledge might cause me to change this statement.

The idea that we must go north for our seed is thus seen to be untenable, except so far that we only find corn in the north that will mature within certain periods. Far more plausible is the idea that we must seek an earlier corn by finding an earlier variety, whether north or south. Thus the Cinquanto from Greece ripened at Ottawa, while the King Philip which originated from New Hampshire is reported as only nearly ripe, and the Dutton, a New England form, as only in early milk.

Per contra, to this estimate of climate relations, I would call attention to the statement in my Note X. regarding the Mexican Indian corn and the *Zea canina*.

It is an interesting fact, which would not have been predicted by botanists, that in and about Farmington, Maine, where the Stowell Evergreen sweet does not ripen its seed, there is a large canning industry, and that the State of Maine cans more sweet corn than any other one State, amounting to 614,894 cases in 1891.

XV.

The application of hot water to starch causes it to become plastic. This fact seems to underlie the explanation of the popping of corn. Pop corn contains starch granules arranged within a tough endosperm. When heat is applied the starch becomes plastic, and the water furnishes steam which soon explodes the kernel, and, turning it inside out and expanding the starch, forms a large fluffy snow-white mass. It is only the corneous matter of the pop corn that furnishes the expanded mass of popped corn. When, as is sometimes the case, a small spot of starchy endosperm occupies the lower portion of the kernel, this remains unchanged or simply toasted. Flint corn does not pop becuuse its corneous endosperm is too thin. Upon the application of heat it does not evert, but only spits. From pop corn, therefore, we gain popped corn; from flint corn simply toasted corn or parched corn. Sweet corn and soft corn simply toast, and all the dent corns I have tried simply toast or spit.

When we consider the delicate quality of popped corn and its handsome appearance, as also its large consumption, both in its popped state and as candied, it is a matter of surprise how infrequent is the mention of it in books or other publications. Harshberger says that Dr. Franklin mentions an Indian preparation. "A vessel of sand was heated. The corn was then mixed with this sand and slowly heated until the grain burst. It was then taken out and ground to a fine powder, which kept fresh for a number of years, Heckewelder calls this preparation *psindamocan.*" Romans, in his "Natural History of Florida," writes that the natives "parch and then pound it, taking this pounded material on long journeys." According to Lambert's "History of the New Haven Colony," the Connecticut Indians called parched corn pounded, *yeokheag;* parched corn made into hominy, *roucheage.* The only other Indian names I have found for parched corn are: Caddo, *kishwanto;* Cherokee, *kungwisitung;* Choctaw, *tanchi vluvsha;* Mohawk, *ounouquit-zerleh;* Muskhogee, *achiaposiki;* Seneca, *onaershewfquaw.* The Quichuas of Peru call toasted maize *cancha.* *Pinole* is an Aztec word applied to any kind of grain or seeds parched and ground before being made into dough. I am unable to determine whether the word parched was used as synonymous with toasted or whether it refers to popped, but I suspect the former.

South Framingham, October 4, 1894.

Japanese Characeae—I.

By T. F. Allen.

These observations will be continued as collections come to hand, and for the present no attempt will be made to systematize the species.

1. Chara fragilis Desv. A slender form of this species, differing in no particular from forms collected in other countries. The cortex is tolerably regular; the primary series most prominent, the papillae undeveloped. The bracts are unilateral and equal the oogonium in length, the latter immature.

2 and 3. Ch. coronata A. Br. Three collections of this species have been made, all in the vicinity of Tokio; one form seems to be longer, with long leaves (probably from deeper water). It does not differ from the ordinary forms, even the minute tuft at the apex of the leaves, composed of the terminal cell with two or three elongated nodal bracts, is similar; this form is microcarpa, microptila, unilateralis. The coronula of the oogonium is short with spreading tips, the subtending bracts only half the length of the oogonium, the oospore small, 540 long, 306 broad.

4. Nitella Japonica Allen, Bull. Torr. Club, **20**: 120; **21**: *pl. 188.* Province of Tokio.

5. N. MUCRONATA TENUIOR A. Br. This beautiful form was collected in the province of Ise, and doubtless is to be referred to this variety. The leaves (6) are at times 3-divided (flabellata), and now and then the sub-terminal is septate, thus connecting it with *N. gracilis* Kutz. The whole plant is very slender, leaves 170 in diameter, mucro 34 in diameter at base. The oogonia are usually solitary in both divisions of the leaves; the oospore averages 306 long, 270 broad, with 6 striae; the surface reticulated, the reticulae 2 to 7 in diameter (easily seen with a half-inch lens).

6. N. JAPONICA Allen; from province of Ise.

7. N. ORIENTALIS sp. nov.

Nos. 7, 8 and 9, though variable, may belong to the same species. Plant 6–8 inches long, repeatedly branched, the verticils often densely tufted when young. Leaves 3–4-divided, terminals very slender, of variable length (elongated or very short); oogonia one (or two) at a node; coronula short and small, but the apical cells much longer than the sub-terminal, which are small and disk-shaped. Antheridium 275 in diameter, oospore 306 to 340 long by 270 broad (in our specimens immature).

8. Plant 8 to 10 inches high, very slender, with remote verticils (spreading), consisting of 6 to 8 leaves. Leaves diarthrodactylae, four times divided, terminating in a mucro; the ultimate segments unequal, at times elongated and slender, at times quite short (brachydactylae); the leaf 200 diameter, the first segment 156, the second (102) to 150, the third (88) to 142 the terminal 88 to 95 in diameter, the mucro 55 to 60 long.

Oogonia clustered (2 to 3) at the nodes of the leaves, coronula not elongated, cells connivent, 60 broad, 48 high, and oospore 272 to 306 long, 170 to 240 broad; (measurements of several mature oospores, give length and breadth as follows, 340 by 292, 353 by 306, 360 by 292, 368 by 292, 368 by 306, 368 by 319); with 8 rather blunt ridges, rarely 7 or 9; surface minutely roughened with granules, which are quite coarse and more prominent at one or two points on the shell, usually near the apex.

9. Plant very delicate, often minute, 3 to 4 inches long; leaves 3–4-divided; stem diameter 102, leaf first node 75, second 60, third 36, fourth 34, mucro 70 long, very slender. Antheridia only 75

in diameter; oogonia clustered, oospore 272 to 306 long, 170 to 240 broad; surface too immature to examine. This plant occurs very sparingly among the collections of number 8, which I have received; it is probably a reduced form of that species; its extreme delicacy is shown by the measurements of stem and leaves. These forms 7, 8 and 9 belong to the section *Polyglochin* or diarthrodactylae — brachydactylae — subdivision of *Nitella.* The oogonia being clustered (not isolated at the nodes of the leaf) place the species near the three American sub-species, *microcarpa* A Br., *Glaziovii* Zell, and *megacarpa* Allen, all doubtless forms of one species for which *microcarpa*, the oldest name, is very inappropriate. These species as well as *oligospira* possess oospores with a reticulated membrane, quite distinct from *N. orientalis* Allen; indeed *N. Japonica* Allen is to be included in this group, it was erroneously referred by me to the *oligospira* section, but later collections show distinctly clustered oogonia; the cells of the coronula are however elongated, placing it in alliance with the true *N. polglochin* series, which is separated by coronula characteristics from our *N. orientalis*, which has a short coronula. Illustrations of these new Japanese species will follow later when a series of eight plates can be prepared.

10. NITELLA PAUCICOSTATA sp. nov. Monarthrodactyla, furcata, homoeophylla, gymnocarpa, dioica, apiculata, membrane of oospore granulated. (Series of *N. opaca* Ag.)

Plant 2 to 6 inches high, branched from the base, diffuse and flaccid. Verticils remote, at length becoming crowded above, bearing about eight leaves and usually short peduncles (shoots) which fruit abundantly when very short, close to the base of the verticils. Leaves once divided, often long and slender (bright green and flaccid in our specimens); terminal segments three, about as long as the first segment of leaf, abruptly pointed (like *N. opaca*). Stem 366 to 500 in diameter; leaf first segment 146 to 425 usually 300 diameter; second segment, 170 to 220 usually 170 diameter. Fruit clustered at the node of the leaf; oogonia 2–3, globular; coronula minute, evanescent; oospore about 408 long by 340 broad (400 by 340, 408 by 380, 440 by 374, 440 by 360, 440 by 370); membrane of oospore very minutely roughened; ridges only 4 (or 5); antheridia 488 in diameter.

This species was collected near Tokio, and adds another to the multiplying *opaca* series. In reviewing the species of this series which have roughened oospores, we find that only *N. obtusa* Allen has apiculate leaves; the others have acuminate leaves. From *N. obtusa* the Japanese species is easily distinguished by its small size and small leaves and by its smaller oospore with very few striae or ridges.

Note on Chara sejuncta A. Br.

By T. F. Allen.

Chara sejuncta A. Br. is one of our common plants, but so variable that extreme forms might well be taken for distinct species. The stem is at times covered with long spines; the bracts on the nodes of the leaves as long as or longer than the oogonia; the lowest (naked) segment of the leaf (often a distinctive specific character) is also variable as to length and size. The size of the oospore also, usually the most reliable diagnostic feature of a species, varies greatly. Like other species, the stems may be elongated, slender and diffusely branched, or condensed, stout and simple; of this latter feature no note need be made, but of the size of the oospore and of the length of the bracts in relation to the size of the oogonia, and of the spines to the diameter of the stem, a word is timely. A Mexican form collected recently by Mr. Pringle gives us spines one-half the diameter of the stem in length, lowest leaf node equaling the stipules, anterior bracts one-half the length of the oogonium, oospore with 12–13 ridges, 535 long, 300 broad; antheridium 190 in diameter. These measurements are peculiar and hitherto unique.

This summer I have collected in Lake Champlain and Saratoga Lake (in both localities), always in company with *Chara gymnopus elegans* A. Br., a form with oospores 756 long by 480 broad, having 11 ridges, the bracts quite unilateral, the anterior one-third to one-half the length of the oogonium, the posterior minute and not noticed, the naked node as long as the upper row of stipules; the spines of the stem numerous and minute. The plants are short and compact, of a curiously smooth naked appearance, especially in Lake Saratoga, where they are not so encrusted as in Lake Champlain. This form should be designated as *Chara sejuncta* A. Br., forma compacta, sub-inermis, microptila, unilateralis macrospora.

Orthotrichum gymnostomum Bruch.

BY G. N. BEST.

This rare moss was collected for the first time in North America by Rev. A. C. Waghorne, at Upper Sandy Point, N. F., on the 28th of April last. It appears to have been first found in Germany by Bruch, who gave a description of it in Bridel's *Bryologia Universalis*, 1826. It was afterwards collected at a few places in that country, also in Norway, in Sweden, possibly in England, and more recently in France.

Material for comparison is scarce, and the only specimen I could obtain was a Swedish one kindly loaned me by Mrs. E. G. Britton. Our plant differs from that in being taller, the papillae smaller, ortherwise the agreement is perfect.

Since it is now known that *Orthotrichum gymnostomum* is to be found in this country our botanists will be on the lookout for it, and in order that they may recognize it a brief description is given.

It grows on poplars, in yellowish-green tufts reddish-brown within; stem ½ to 1 cm. tall, erect, rigid, usually simple, sometimes branching, with one or more clavate innovations; leaves when dry closely imbricated, when moist spreading, oblong-ovate concave-carinate, obtuse with the margin involute except at the base, nerve narrow, disappearing under the apex; perichetial similar but longer, oblong-lanceolate, usually plane at the rounded or blunt apex; areolation angular, middle basal cells broadly linear, quadrate at the angles, upper oblong-rhomboidal, apical oval or roundish, each cell with one or two stout papillae, these sometimes bifurcated.

Dioicous; male plants smaller in seperate tufts or mixed with the female; calyptra plicate, conical, hairless, rough and black at apex, scarcely covering one-third of the capsule; operculum narrowly conical from a convex base; capsule immersed, oblong-ovate, oblong when dry and empty, rounded at the truncate base, without peristome, neck shorter than sporange, stomata superficial, only a few and these near the mouth, bands eight, yellowish, composed of two to four rows of yellowish thick-walled cells; pedicel very short.

Although closely related to *Orthotrichum obtusifolium* Schrad., it may readily be distinguished from this by the angular cells, involute leaves, absence of peristome and the neck shorter than the sporange.

ROSEMONT, N. J.

Microsphaera densissima (Schwein.) Peck.

BY GEO. F. ATKINSON.

This very interesting species first described by Schweinitz* as *Erysiphe densissima*, was collected by me at Ithaca, N. Y., August 7, 1893. There has been some uncertainty as to the identity of this species of Schweinitz, and probably for this reason Burrill omits a description of it in his latest work on the Erysipheae.† It is only mentioned in a discussion of its once supposed identity with a very different fungus, *Microsphaera calocladophora*,‡ Atkinson. In his article on the Erysipheae§ of Illinois, Burrill refers to it as follows: "*Microsphaera densissima* (Schw.) Peck, cannot be distinguished by its perithecia from the ordinary form on *Q. rubra;* but it presents some peculiarities of the mycelium, which if constant would entitle it to specific distinctness." The specimens agree perfectly, it seems to me, with Schweinitz' description, the patches of whitish mycelium being very dense with a long filamentous tomentum. The patches are beautifully orbicular, the prostrate threads lying close to the leaf and beautifully radiate from the center. The portions of the leaf on which the mycelium is seated are very much injured, so that they become yellowish and marked with numerous black spots on the lower side. It occurs at Ithaca on *Quercus tinctoria*. According to Burrill, Peck reports it on *Q. tinctoria*. In the 26th Report of the New York State Museum, p. 80, Peck reports it on fallen leaves. Several years ago while studying the species‖ which occurs on *Q. aquatica* and *Q. laurifolia* in the Southern States

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* Syn. Am. Bor. n. 2479.

† Ellis' North Am. Pyren. 29.

‡ Some Erysipheae from Carolina and Alabama. Jour. Elisha Mitchell Society 7: 13.

§ Bull. Ill. State Lab. Nat. Hist. 2: 426. 1887.

‖ *Microsphaera calocladophora* Atkinson. See note ‡.

I was enabled through the kindness of Dr. Peck to examine a specimen of the fungus which he referred to this species. The specimens which I have collected at Ithaca agree perfectly with those collected by Dr. Peck. The fungus has occurred again at Ithaca during the summer of 1894, on the leaves of the same oak tree.

Fissidens hyalinus in Pennsylvania.

Fissidens hyalinus, according to Icones Muscorum and the Manual, is a very rare moss, since it has been found in only two places and is extinct in these. We have been able, however, to gather small quantities of it in four different places. We first met with it growing on the steep banks of a moist shaded ravine, along with *F. taxifolius*, and by searching similar ravines, and using *F. taxifolius* as a guide, we found it in three other places. Possibly then this little moss is more widely distributed than has been supposed, and has been simply overlooked on account of its insignificant appearance and the small quantity of it growing in one spot.

A more careful search might discover it in many parts of the country. The *F. taxifolius* may serve as a guide. Where this grows on the moist banks of shaded ravines, our little moss may be searched for. The best time for the search is from September to November, when it is in fruit; for its red peristome will betray its presence to a sharp eye held near the ground. It is a good plan to take up slices of earth where smaller plants of *F. taxifolius* grow somewhat loosely, and examine these with the aid of a good magnifying glass. The red peristome of *F. hyalinus*, if it is in fruit, is readily detected, and its leaf is easily recognized from the fact that it is without a costa, and its large cells give it a resemblance to the leaf of *Physcomitrium*.

This moss does not grow in thick and wide-spread mats which would discover it to the eye notwithstanding its small size; clusters of 20 to 50 plants may be found, but much more frequently it grows separately.

ALONZO LINN,
JAS. S. SIMONTON.

WASHINGTON AND JEFFERSON COLLEGE, WASHINGTON, PA.

Proceedings of the Club.

TUESDAY EVENING, NOVEMBER 13TH, 1894.

The President in the chair and 16 persons present.

The minutes of the meeting of October 31st were read and approved.

Mr. Henry Ogden, Treasurer, reported that he had received the legacy of $500 less $25, collateral inheritance tax, bequeathed to the Club by the late Isaac Buchanan, and recommended that it be permanently invested. The matter was referred to the Finance Committee with the request that they report on methods of investment at the next meeting.

The committee appointed to draft resolutions relative to the death of Mrs. Maria L. Daly submitted the following, which were approved and ordered printed in the BULLETIN.

Resolved, That by the death of Mrs. Maria Lydig Daly the Torrey Club has lost one of its most valuable members and sympathetic workers. Though Mrs. Daly, since her connection with the Club, was not often able to attend the meetings, yet she took a keen interest in its proceedings, made herself acquainted with many of its members and associated herself prominently with one of its dearest objects, the founding of the Botanic Garden, which the Club has long been working to establish. When the original efforts for that object were languishing it was largely through the stimulus of Mrs. Daly's zeal and social influence, supported by the hearty coöperation of her husband, Ex-Chief Justice Daly, that the revival of a more extended interest in the enterprise was accomplished; and that, through the opportunities for consultation and friendly intercourse at her home, a direction was given to the movement by which the present organization and promise of success have been reached. She always took great interest in the meetings of all the Garden Committees, and she was herself Chairman of the Ladies' Committee, whose first meeting was held at her house.

She was born on that part of Bronx Park known as the Lydig Estate. She was deeply interested in the plans of the committee who selected that site for the Botanic Garden, and was largely influential in furthering their aims. Mrs. Daly was passionately fond of flowers. In her city home she had them always about her, while in her country place on Long Island she cultivated many of the old favorities, and mourned that fashions in flowers, as well as in other beautiful things, should make it difficult to secure some of the old-fashioned kinds.

Her frequent association with eminent travelers, the guests of her husband, the eminent President of The Geographical Society, broadened her knowledge and her interest in beautiful plants from all parts of the world. Personally, Mrs. Daly was distinguished by great natural dignity and impressiveness of character; by great charm of manner, broad-minded and intelligent culture, and by open-handed hospitality; and many will miss her warm and loyal friendship.

In her death, the members of the Torrey Botanical Club have lost a loved friend and associate; and the Ladies' Committee, a most valuable Chairman and leader.

Resolved, That we tender to her husband, the Hon. Charles P. Daly, this expression of our appreciation and sympathy and sorrow; and that a copy of these resolutions be presented to him, and be embodied in the proceedings of the Club.

Signed: ANNA MURRAY VAIL,
LENA POTTER COWDIN,
ADDISON BROWN,
Committee.

The following papers were presented:

"On two Species of *Oxalis*," by Mr. John K. Small (published in the November BULLETIN).

"Family Nomenclature," by Mr. John Hendley Barnhart (to be published in the January BULLETIN).

"Note on *Chara sejuncta*." "Japanese Characeae—I.," by Dr. T. F. Allen (published in this issue of the BULLETIN).

Dr. Rusby reported informally that the Trustees of the College of Pharmacy had granted the request of the Club to allow its herbarium to be deposited in their new building.

Dr. Rusby exhibited a specimen of *Azalea nudiflora*, collected in flower at Ulsterville, Ulster county, on November 2d. A general discussion of the phenomena of the second blooming of hardy trees and shrubs followed, during which it was brought out that they are mainly produced by the premature expansion of buds which under ordinary conditions would develop the following spring. *Hamamelis Virginiana* was cited as seemingly the latest blooming shrub of our Flora, while in reality it is the earliest.

TUESDAY EVENING, NOVEMBER 27TH, 1894.

Dr. Britton in the chair.

Mr. L. S. Livingston, 22 East 16th Street, New York City, was elected an active member.

The Finance Committee reported in favor of investing the Buchanan bequest in a savings bank. Upon motion it was unanimously resolved that the report be accepted and approved and that the Treasurer be empowered to make such investment in a savings bank of his selection.

The announced papers of the evening were then read:

1. By Dr. Emily L. Gregory, "Notes on Plant Physiology in German Laboratories."

2. By Dr. Albert Schneider, "Notes on some Lichens of Eastern North America." In connection with the latter paper Dr. Schneider offered some interesting suggestions, based upon his own observations, concerning "Accidental Symbiosis" and concerning the development of chlorophyll bodies.

Dr. Britton exhibited specimens of *Chenopodium album* L. and *C. viride* L., commenting on the general distribution of the former westward and of the latter in the east, and calling attention to the difference in the time of flowering of the two species when they grow together. He requested that observations be made and notes communicated bearing upon the specific distinctness of the two forms. Discussing this paper Dr. Rusby called attention to the close similarity between *C. album* and *C. Quinoa* when found growing wild together in the Andean region.

Reviews.

*Contributions to Lichenology.**—Part I. of Reinke's contributions treats of the podetium of *Cladonia*. It is essentially a criticism of Krabbe's monograph of *Cladonia*. Krabbe maintains that the podetium is the fruit (Frucht) of *Cladonia*, whether it be sterile or fertile. Reinke takes objection to this view, maintaining that all podetia are functially thalloid, hence assimilative and not reproductive. They are considered to be peculiarly modified portions of the thallus or adventitious branches developing endogenously from the "gonidial" (algal) layer of the thallus. They possess a gonidial zone which enables them to function as the thallus proper; indeed in some *Cladonia* species the thallus is rudimentary or wholly wanting, in which case the assimilating function devolves wholly upon the podetia. Sometimes they continue to grow for centuries without bearing apothecia or pycnidia, sometimes they bear both and in addition soredia. In fact, they develop, grow and function as the thallus proper.

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* Abhandlungen uber Flechten von J. Reinke in Kiel. Pringsheim Jahrbücher. Heft 3, 1894.

In Part II. Reinke discusses the position of lichens in the vegetable kingdom. The author places lichens as an independent branch of the plant kingdom, having a special phylogeny. His idea is essentially as follows: In the beginning lichens originated through the association of a fungus and an alga in which the fungus played the part of a true parasite, hence the symbiosis was not yet mutualistic. Through natural selection or some other factor the symbionts developed into a morphological unit, for example, *Collema* thallus. Out of this first lichen (*Collema*) other species have branched off. Lichens belong neither to the algæ nor to fungi. The author considers a lichen as perfect a morphological unit as a tree. He suggests that it may be possible to separate the green and colorless portions of higher plants. (The writer would here state that theoretically chloroplastids of phanerogams must be looked upon as much modified algæ, or at least as chlorophyll bearing and CO_2 assimilating living units.) The true reproductive organs of the lichen are the soredia, since they alone possess the structures capable of producing a new lichen. The spores cannot develop a new lichen until they can develop with the essential alga. Hyphæ and gonidia (algæ) have the same relation to each other as the green and colorless cells in *Riccia* and *Marchantia*. Therefore, lichens should not be placed subordinate to fungi, as is almost universally done now.

In conclusion, the writer would express it as his opinion that most modern lichenologists agree with the author as to the lichen nature. The lichen structure is certainly more or less of a morphological unit. In the ages to come the lichens may be placed as a separate class. By that time they may have become more decidedly individualized as units. Our present knowlege of their morphology certainly makes it most convenient to arrange them under fungi as ascolichenes and basidiolichenes rather than a separate class. ALBERT SCHNEIDER.

Flora of Nebraska.—Edited by members of the Botanical Seminar of the University of Nebraska. Introduction and Part 1, Protophyta-Phycophyta; Part 2, Coleochaetaceae, Characeae (4to, pp. 128, *pl. 36.* Lincoln, Nebraska, published by the Seminar, 1894).

The beautiful work here noticed must long hold first place in the published results of the exploration and study of a local flora. It is hard to find words in which to express our gratification at its appearance, and we have tried in vain to find any point which is fairly open to adverse criticism. Beginning with a synopsis of the larger groups, including families, and an introduction contributed by Professor Bessey, in the details of which there is room for much difference of opinion, there follow concise descriptions of the classes, orders, families, genera, species and varieties of Protophyta and Phycophyta found within the State, contributed by Mr. DeAlton Saunders, and of the Coleochaetaceae and Characeae by Mr. Albert F. Woods. The descriptions are well drawn, the typography excellent and the plates accurate and well executed. We tender our cordial congratulations to all concerned in the production of the book and to all who may have opportunity to use it. N. L. B.

Ueber neue fossile Pflanzenreste vom Cerro de Potosi. H. Engelhardt. (Abh. Isis, Jahrg. 1894, 3–13. *pl. 1.*)

This is the third contribution published on the flora of the volcanic ash deposits of Cerro de Potosi, Bolivia. The author of the present paper first gave an account of the plant remains, with descriptions of six new species, in Abh. Isis, Jahrg. 1887, 36, 38, *pl. 1.* Some years later further collections were made which were examined by Dr. N. L. Britton, who published the results of his examination in Trans. Am. Inst. Min. Eng. **21**: 250–259, with descriptions and figures of ten more new species. The present paper adds thirty-five to those already published, and it is of interest to note that they have nearly all been referred to genera which now inhabit the region and to species evidently closely allied if not identical with living ones. A. H.

Index to recent Literature relating to American Botany.*

Arthur, J. C. Wild or Prickly Lettuce. Bull. Ind. Exp. Sta. 52: 83–114. *pl. 4.* N. 1894.

Lactuca scariola L. is a serious weed of recent introduction and a well-marked compass plant.

Atkinson, G. F. *Completoria complens* Lohde. Bot. Gaz. **19**: 467, 468. 16 N. 1894.

Found parasitic in fern prothallia.

Bailey, L. H. Peach Yellows. Bull. N. Y. (Cornell) Exp. Sta. 75: 390–408. *f. 8.* O. 1894.

Bastin, E. S. Structure of *Asarum Canadense* L. Am. Journ. Pharm. **66**: 574–580. *figs.* D. 1894.

Beal, W. J. *Puccinia malvacearum.* Bot. Gaz. **19**: 468. 16 N. 1894.

Notes the introduction of this fungus into Michigan.

Bergen, F. D. Popular American Plant-names—III. Bot. Gaz. **19**: 429–444. 16 N. 1894.

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* This record is compiled by the Editors with the coöperation of Prof. L. M. Underwood, Mr. F. V. Coville and Prof. Conway MacMillan. It is earnestly requested that omissions be communicated to any of the Editors. The titles are reprinted on library cards by the Cambridge Botanical Supply Co., thus making it possible for any one to receive the complete record, beginning January, 1894, alphabetically arranged.

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